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Infrared spectra of minerals

Reference guide to identification and characterization of minerals for the study of soils



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Infrared spectra of minerals

Reference guide to identification and
characterization of minerals
for the study of soils

H. KODAMA
Chemistry and Biology Research Institute
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Research Branch
Agriculture Canada
1985

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SUMMARY

Infrared spectroscopy has been used successfully as a tool in identifying minerals and in deriving information regarding structures, compositions and surface reactivities of minerals for the last two decades. Earlier infrared data of minerals were published between 1905 and 1910 by W.W. Coblentz from the U.S. Bureau of Standards. For many years, until the mid-1940's when infrared spectrophotometers became commercially available, the predominant use of infrared spectroscopy had been in organic chemistry. Since 1945 a considerable amount of literature has been published on the infrared spectra of minerals. One of the earliest reviews was prepared by R.J.P. Lyon and was published in 1962 as a monograph entitled Minerals in the infrared -- a critical bibliography. In the same year, H. Moenke published Mineralspektren I and supplemented it by adding Mineralspektren II in 1966 to complete a data file of infrared spectra in the $400\text{--}4000\text{ cm}^{-1}$ region of 462 minerals. This file has been a very useful data source for many researchers. Perhaps the first comprehensive review on both theoretical and practical aspects of infrared spectra of minerals appeared in 1974 as a book entitled The infrared spectra of minerals edited by V.C. Farmer. For clay minerals, H.W. vander Marel and H. Beutelspacher published Atlas of infrared spectroscopy of clay minerals and their admixtures in 1976.

This short historical background illustrates that demands have grown rapidly. As one of the researchers who uses the infrared spectroscopic method for soil mineral identification and characterization I share with others the opinion that a concise and comprehensive infrared data file is still needed for soil minerals. One of the main reasons for this is because many infrared

spectra of minerals are scattered in various articles and are also often partial. Furthermore, although the majority of soil minerals are phyllosilicates, Moenke's data file contains spectra of only 42 phyllosilicates and does not cover a wide variety of specimens within the mineral species that we often encounter in soils. This situation has prompted me to prepare the present compilation.

Nearly 500 infrared spectra were recorded. Of these, 327 spectra were selected as standard spectra for 281 standard and reference minerals that included mainly silicates, oxides, oxyhydroxides, hydroxides, carbonates, sulfates and phosphates. The selection of the minerals was made on the basis of their occurrence in soils or their structural similarities to the minerals occurring in soils. The spectra provide all the absorption bands in the region ranging from 300 to 4000 cm^{-1} . Each data sheet contains the spectrum of a mineral and the frequencies of absorption bands along with mineral species name, mineral group name, origin of sample, type of specimen, ideal chemical formula and, if available, real chemical formula, basic crystallographic data, and so on. At the end of this file, a mineral index is given. I included in the index as many synonyms as possible to facilitate the finding of a spectrum.

Spectroscopie de minéraux dans l'infrarouge

par H. Kodama

RESUME

Depuis les deux dernières décennies, la spectroscopie dans l'infrarouge est utilisée avec succès dans l'identification de minéraux et dans l'obtention d'information sur les structures, les compositions et les réactivités superficielles de minéraux. Des données antérieures ont été publiées entre 1905 et 1910 par W.W. Coblentz du U.S. Bureau of Standards. Pendant plusieurs années, jusqu'au milieu des années 1940 lorsque les spectrophotomètres à l'infrarouge ont fait leur apparition dans le commerce, c'est en chimie organique que la spectroscopie à l'infrarouge a trouvé sa principale utilisation. Depuis 1945, beaucoup d'articles ont été publiés sur les spectres d'absorption dans l'infrarouge de composés inorganiques et de minéraux. L'une des revues bibliographiques les plus récentes sur les spectres d'absorption de minéraux dans l'infrarouge a été préparée par R.J.P. Lyon et publiée en 1962 sous forme de monographie intitulée Minéraux dans l'infrarouge - Une bibliographie critique. La même année, H. Moenke publiait Minralspektren I et complétait ce premier ouvrage par un autre intitulé Mineralspektren II en 1966 pour compléter un fichier de données de spectres dans l'infrarouge dans la région des $400 \text{ à } 4\,000 \text{ cm}^{-1}$ pour 462 minéraux. Ce fichier a constitué une source de données très utile pour de nombreux chercheurs. Peut-être la première étude bibliographique détaillée des aspects théoriques et pratiques des

spectres de minéraux dans l'infrarouge est-elle apparue en 1974 sous forme d'un manuel intitulé Les spectres de minéraux dans l'infrarouge rédigé par V.C. Farmer. Pour ce qui des minéraux argileux, H.W. Vander Marel et H. Beutelspacher publiaient Atlas de la spectroscopie à l'infrarouge de minéraux argileux et de leurs mélanges en 1976.

Ce bref rappel historique témoigne du fait que la demande n'a cessé d'augmenter rapidement. Comme je fais partie des chercheurs qui utilisent la méthode spectroscopique à l'infrarouge pour l'identification et la caractérisation des minéraux du sol, je partage avec d'autres l'opinion selon laquelle un fichier de données sur l'infrarouge, à la fois concis et complet, est encore nécessaire pour les minéraux du sol. L'une des principales raisons tient au fait que de nombreux spectres de minéraux dans l'infrarouge sont dispersés dans divers articles et souvent incomplets. Qui plus est, même si la majorité des minéraux du sol sont des phyllosilicates, le fichier de données de Moenke contient les spectres de seulement 42 phyllosilicates et ne couvre pas un large éventail de spécimens dans les types de minéraux que nous rencontrons souvent dans les sols. Cette situation m'a incité à préparer la présente compilation.

Près de 500 spectres dans l'infrarouge ont été enregistrés dont 327 ont été choisis comme étalons pour 281 minéraux standards et de référence composés principalement de silicates, d'oxydes, d'oxyhydroxydes, d'hydroxydes, de carbonates, de sulfates et de phosphates. La sélection des minéraux s'appuie sur leur fréquence d'apparition dans les sols ou sur leurs similarités

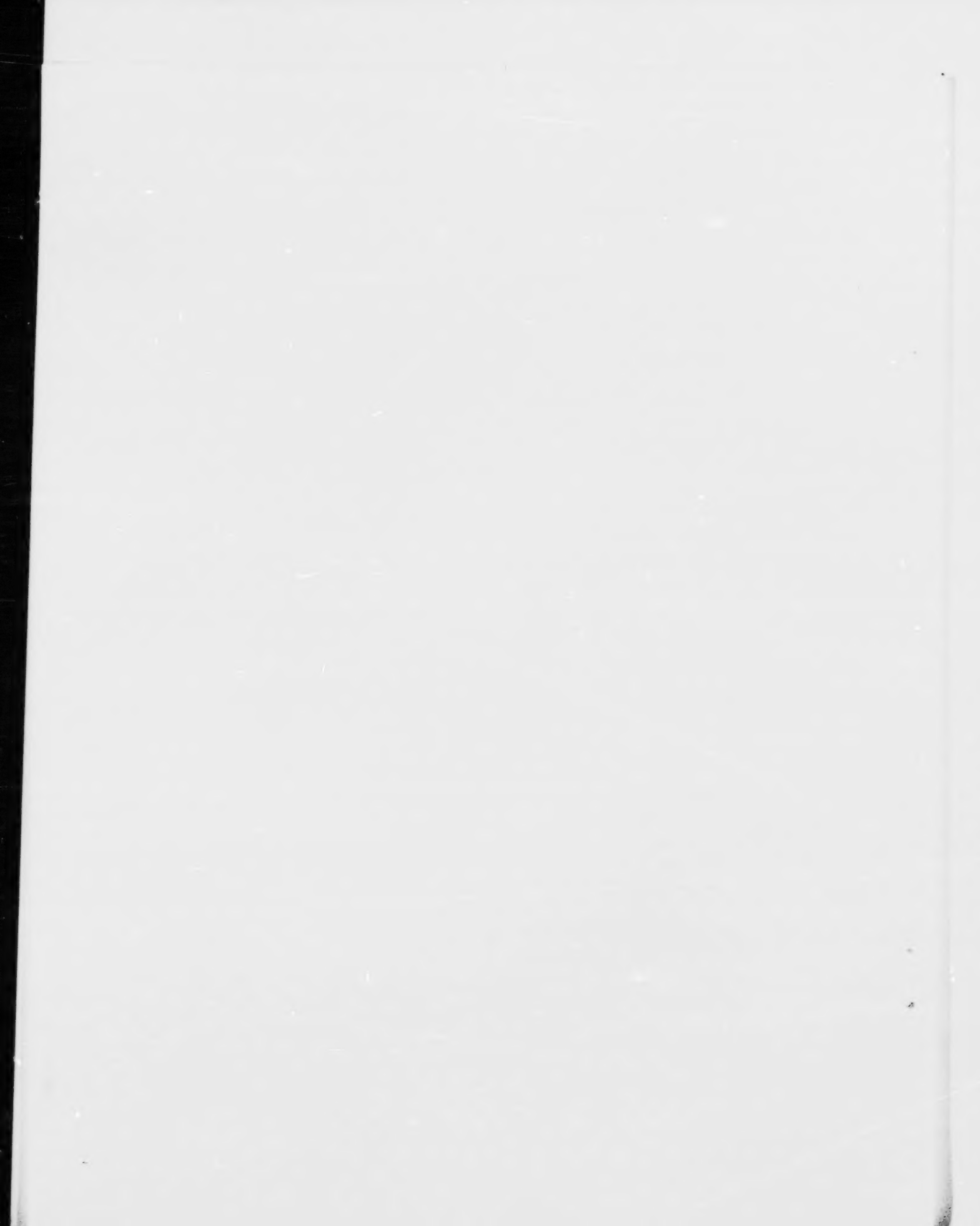
structurales avec les minéraux rencontrés dans les sols. Les spectres donnent toutes les bandes d'absorption dans la région de 300 à 4 000 cm^{-1} . Chaque feuille de données contient le spectre d'un minéral, ainsi que les fréquences des bandes d'absorption avec le nom du type de minéral, le nom du groupe du minéral, l'origine de l'échantillon, le type de spécimen, la formule chimique idéale et, s'il y a lieu, la formule chimique réelle, les données cristallographiques de base, etc. On trouve un index du minéral à la fin de cette fiche. J'ai inclus dans l'index le plus grand nombre de synonymes possible pour faciliter la recherche d'un spectre.

ACKNOWLEDGMENTS

I am particularly grateful to Wolfgang Nagel, a student from Carleton University, for his excellent assistance during the summers of 1981 and 1982 in preparing samples, obtaining spectra, and measuring frequencies. Without his assistance this compilation of infrared spectra would never have been achieved. I am indebted to Mr. C. Halchuk of the Graphics Section, Research Program Service, for the graphic illustrations and Mr. B. Edwards of Cartography Section, Land Resource Research Institute, for the reproduction of spectra. I am also indebted to Mrs. D. Archibald for editing of this monograph. I thank H. G. Ansell, Mineral Identification Service, Geological Survey of Canada, for supplying minerals denoted by G. S. C. numbers. Thanks are also due to the following colleagues who kindly provided their precious samples: H. Hayashi, J. T. Iiyama, N. M. Miles, K. Norrish, K. Oinuma, H. Pézerat, G. J. Ross, S. Shimoda, S. S. Singh, and T. Sudo.

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NOTES TO USERS

All infrared spectra filed in this monograph were obtained on samples in KBr pellets using a Beckman IR 4250 spectrophotometer. The spectra were recorded in the range from 300 to 4000 cm^{-1} with a scanning speed of $300\text{ cm}^{-1}/\text{min}$. Other experimental conditions were as follows: gain: 0.60 ~ 0.72, period: 1 sec., slit width: 0.3 mm at 3000 cm^{-1} . The sample concentrations ranged from 0.25 to 5 mg per 400 mg KBr. For most cases, the particle size of samples was less than 45 μm unless otherwise stated. To facilitate identification of mineral species within certain mineral series or groups that show a systematic shift of a characteristic absorption band(s), the spectra in a pertinent region were recorded again with a slow scanning speed on an expanded scale.

The minerals used for this data file are all kept in the Mineral Analyses Service Laboratory, Chemistry and Biology Research Institute, Agriculture Canada. These reference and standard minerals are from the Laboratory's collection, the Geological Survey of Canada, and private donations. Most of the minerals were examined by the X-ray diffraction method for their purity. Absorption bands obviously due to impurity are marked by an asterisk (*).

Although the structures of minerals are highly complicated compared to those of simple diatomic or triatomic molecules, as first approximation it is often useful to interpret the spectra of minerals in terms of normal vibrations of simple molecules or atom groups, which the minerals contain. I chose some fundamental molecules pertinent to the minerals considered in the present file. Figure 1 represents normal modes of vibration of the fundamental molecules. Infrared active vibrations are denoted with the sign,

IR, at the upper right corner of each of the vibrational modes in Fig. 1. Expected frequencies of these infrared active vibrations are given in Fig. 2. Figures 3a and 3b display the range of frequencies (where absorption bands appear) determined for each mineral group from the infrared spectra obtained. For convenience, the whole range from 300 to 4000 cm^{-1} was divided into four regions (A, B, C and D) and regions A, B, and D were further divided as shown in Fig. 4. These divisions and subdivisions were used to describe characteristic absorption bands in order to facilitate comparisons between spectra. At the end of this bulletin, the Mineral Index lists many mineral names without their spectra. These will be included in the future, if the mineral samples are available.

SYMBOLS AND ABBREVIATIONS

a, b, c	Absolute unit cell dimensions in Angstrom units (10^{-10} m) along the respective axes.
a_{rh}	Rhombohedral unit cell in Å.
α, β, γ	Crystallographic axial angles.
Z	Number of formula units per cell.
D	Density.
CONC.	Concentration of mineral sample in mg 400 mg KBr.
SPACE GROUP	The number given in parentheses is the one from the International Tables for X-ray crystallography (Vol. 1).
EDXRA	Energy dispersive X-ray analysis.

sh Shoulder-like absorption peak.

vs, s, ms, m, Very strong, strong, medium strong, medium,
mw, w, vw medium weak, weak, very weak, respectively.

) Bracket indicates a group of absorption bands on a large absorption peak.

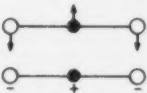
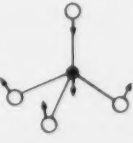
TYPE OF MOLECULES	EXAMPLE	ν_1	ν_2	ν_3	ν_4
XY	OH	 IR			
XY ₂ (LINEAR)	CO ₂	 IR	 IR	 IR	
XY ₂ (BENT)	H ₂ O	 IR	 IR	 IR	
XY ₃ (PYRAMIDAL)	NH ₃	 IR	 IR	 IR	 IR
XY ₃ (PLANAR)	CO ₃ ²⁻ NO ₃ ⁻ [BO ₃] ³⁻	 IR	 IR	 IR	 IR
XY ₄ (TETRAHEDRAL)	NH ₄ ⁺ SO ₄ ²⁻ PO ₄ ³⁻ VO ₄ ³⁻ AsO ₄ ³⁻ MoO ₄ ²⁻ SiO ₄ ²⁻	 IR	 IR	 IR	 IR

Fig. 1. Normal modes of vibration of some fundamental molecules related to minerals selected for this monograph.

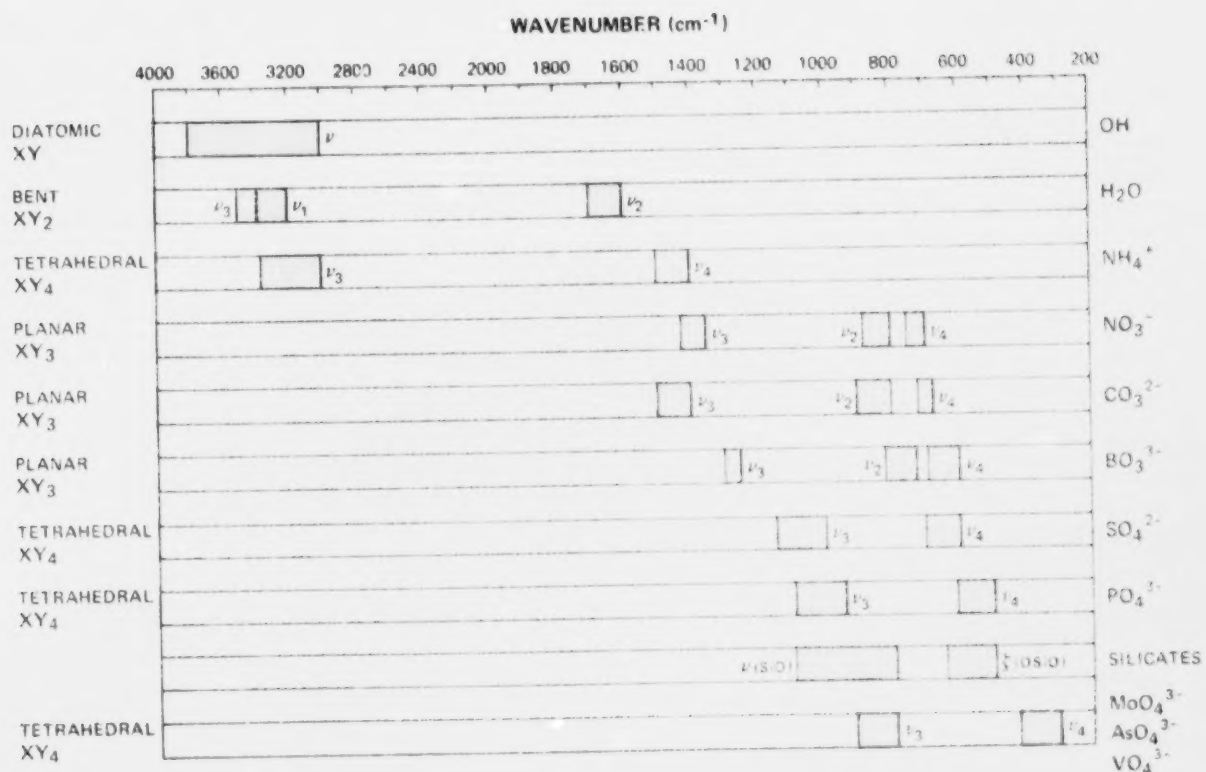


Fig. 2. Characteristic frequencies of infrared active vibrations given in Fig. 1.

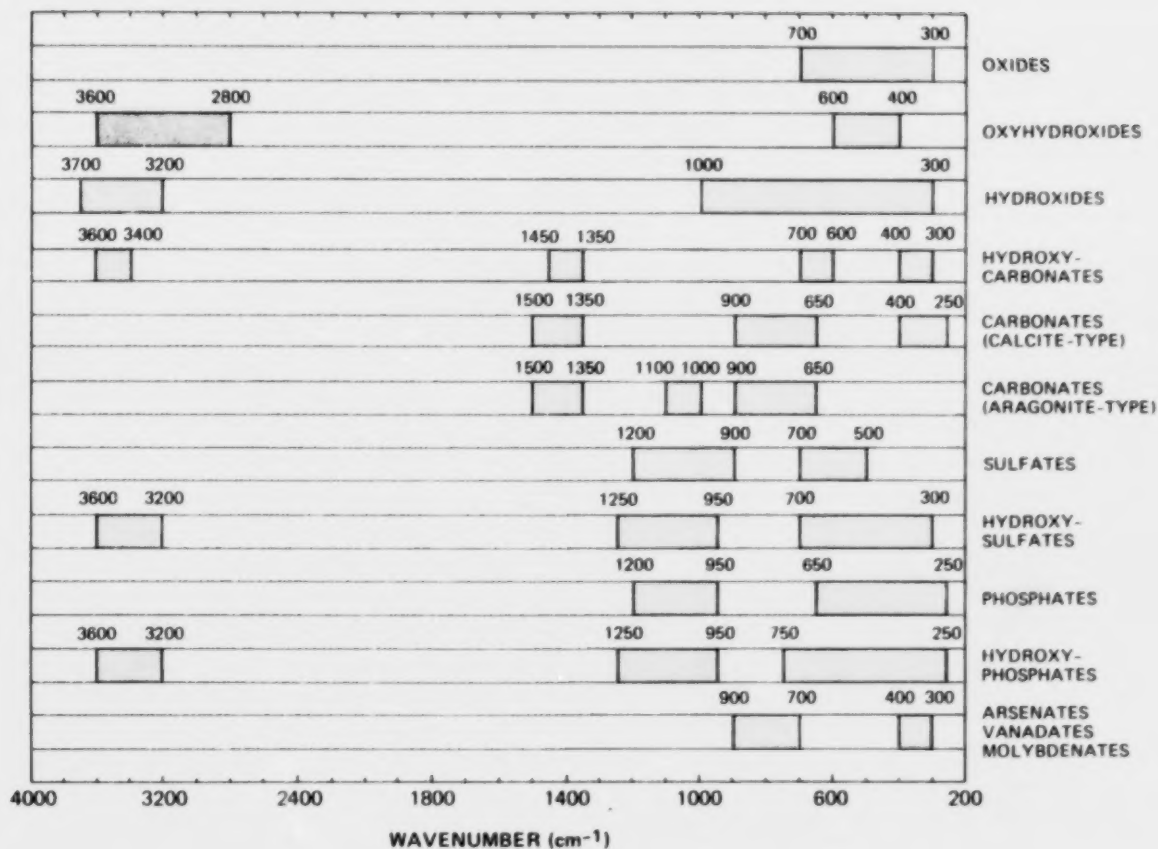


Fig. 3a. The range of frequencies of absorption bands observed in minerals selected for this monograph except silica and silicate minerals.

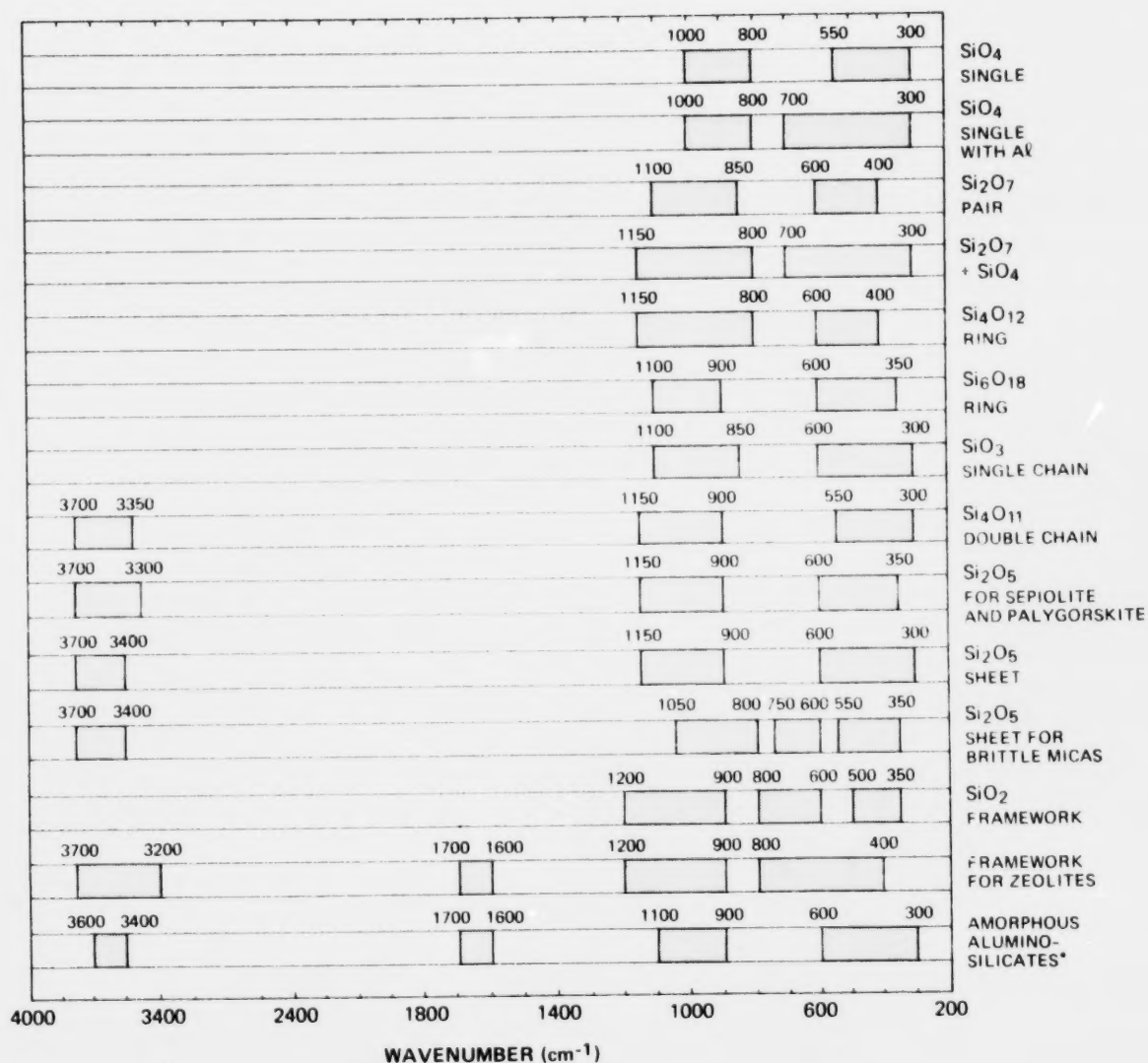


Fig. 3b. The range of frequencies of absorption band observed in silica and silicate minerals selected for this monograph.

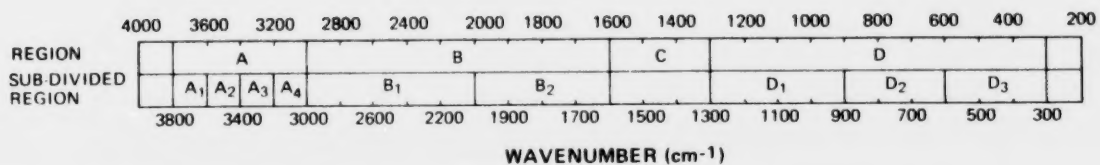


Fig. 4. Conventional divisions of the whole range (300-4000 cm^{-1}) which are used in this monograph to facilitate comparisons between spectra.

MINERAL NAME HEMATITE	SUB GROUP	GROUP HEMATITE	CLASS OXIDES	SPECTRA NO 288
CHEMICAL FORMULA (IDEAL) $\alpha\text{-Fe}_2\text{O}_3$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $P\bar{3}c$ (167)	a: 5.0340 α:	b: β:	c: 13.752 γ: Z: 6 D: 5.271
ORIGIN OF SAMPLE Quebec, CANADA	REMARKS		PARTICLE SIZE	CONC 1 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			D ₂ <u>620 sh ms</u> 541 s 465 ms D ₃ <u>370 sh m</u> 332 s	

MINERAL NAME CORUNDUM	SUB GROUP	GROUP HEMATITE	CLASS OXIDES	SPECTRA NO 304
CHEMICAL FORMULA (IDEAL) $\alpha\text{-Al}_2\text{O}_3$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $R\bar{3}c$ (167)	a: 4.758 α:	b: β:	c: 12.991 γ: Z: 6 D: 3.987
ORIGIN OF SAMPLE MADAGASCAR	REMARKS		PARTICLE SIZE	CONC 2 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			D ₂ <u>637 sh ms</u> 598 ms 447 ms D ₃ <u>372 m</u> 348 m	

MINERAL NAME ILMENITE	SUB GROUP	GROUP HEMATITE	CLASS OXIDES	SPECTRA NO 305
CHEMICAL FORMULA (IDEAL) FeTiO_3		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRIGONAL (RHOMBOHEDRAL)	SPACE GROUP $R\bar{3} (148)$	a: 5,523 a: 54.51°	b: β:	c: γ:
ORIGIN OF SAMPLE St. Urbain, Québec, CANADA		REMARKS	PARTICLE SIZE	CONC 2 mg
			MAJOR ABSORPTION BANDS (cm^{-1}) D D₃ 534 m 441 m	

MINERAL NAME MAGHEMITE	SUB GROUP	GROUP HEMATITE	CLASS OXIDES	SPECTRA NO 287
CHEMICAL FORMULA (IDEAL) $\gamma\text{-Fe}_2\text{O}_3$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC (TETRAGONAL?)	SPACE GROUP $P2_13 (198)$ $P4_2 93 ?$	a: 8.35 a: (8.33)	b: β:	c: (24.99) γ:
ORIGIN OF SAMPLE Synthetic		REMARKS	PARTICLE SIZE	CONC 0.8mg
			MAJOR ABSORPTION BANDS (cm^{-1}) D₂ 721) sh 690 ms 636 s D 560 s 480 ms D₃ 440 ms 418 ms 394 ms 363 sh	

MINERAL NAME RUTILE	SUB GROUP	GROUP RUTILE	CLASS OXIDES	SPECTRA NO 320												
CHEMICAL FORMULA (IDEAL) TiO₂		CHEMICAL FORMULA (ACTUAL)														
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP P4₂/mm(136)	a: 4.5933 α:	b: β:	c: 2.9592 γ: Z: 2 D: 4.250												
ORIGIN OF SAMPLE Unknown	REMARKS		PARTICLE SIZE	CONC 2.4 mg												
			MAJOR ABSORPTION BANDS (cm ⁻¹)													
			<table> <tr> <td>D₂</td> <td>720</td> <td>sh</td> </tr> <tr> <td></td> <td>600</td> <td>sh</td> </tr> <tr> <td>D</td> <td>525</td> <td>s</td> </tr> <tr> <td>D₃</td> <td>397</td> <td>s</td> </tr> <tr> <td></td> <td>332</td> <td>s</td> </tr> </table>		D ₂	720	sh		600	sh	D	525	s	D ₃	397	s
D ₂	720	sh														
	600	sh														
D	525	s														
D ₃	397	s														
	332	s														

MINERAL NAME CASSITERITE	SUB GROUP	GROUP RITILE	CLASS OXIDES	SPECTRA NO 299													
CHEMICAL FORMULA (IDEAL) SnO₂		CHEMICAL FORMULA (ACTUAL)															
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP P4/mm(136)	a: 4.738 α:	b: β:	c: 3.188 γ: Z: 2 D: 6.995													
ORIGIN OF SAMPLE Naegi, Gifu, JAPAN	REMARKS		PARTICLE SIZE	CONC 4 mg													
			MAJOR ABSORPTION BANDS (cm ⁻¹)														
			<table> <tr> <td>D₂</td> <td>690</td> <td>sh</td> <td>ms</td> </tr> <tr> <td></td> <td>637</td> <td></td> <td>ms</td> </tr> <tr> <td>D₃</td> <td>530</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td>430</td> <td></td> <td>m</td> </tr> </table>		D ₂	690	sh	ms		637		ms	D ₃	530		ms	
D ₂	690	sh	ms														
	637		ms														
D ₃	530		ms														
	430		m														

MINERAL NAME ZINCITE	SUB GROUP	GROUP	CLASS OXIDES	SPECTRA NO. 303
CHEMICAL FORMULA (IDEAL) (Zn, Mn)O		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP P6₃mc (186)	a: 3.249 α:	b: β:	c: 5.205 γ: Z: 2 D: 5.680
ORIGIN OF SAMPLE Franklin, NEW JERSEY, USA	REMARKS		PARTICLE SIZE	CONC. 2 mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			D 525 sh mw D₃ 430 ms	

MINERAL NAME SPINEL	SUB GROUP	GROUP SPINEL	CLASS OXIDES	SPECTRA NO. 306
CHEMICAL FORMULA (IDEAL) MgAl₂O₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP Fd3m (227)	a: 8.0831 α:	b: β:	c: Z: 8 D: 3.578
ORIGIN OF SAMPLE Salem Dist. Madras, INDIA	REMARKS		PARTICLE SIZE	CONC. 2 mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			D 740 sh ms 672 s D₃ 571 sh ms 503 s	

MINERAL NAME GAHNITE	SUB GROUP	GROUP SPINEL	CLASS OXIDES	SPECTRA NO 301
CHEMICAL FORMULA (IDEAL) ZnAl₂O₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP Fd3m (227)	a: 8.0848 α:	b: β:	c: γ: Z: 8 D: 4.607
ORIGIN OF SAMPLE Waku, Fukushima, JAPAN	REMARKS	PARTICLE SIZE	CONC. 2 mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		
		D ₂ 730 sh m 663 ms D ₃ 550 ms 496 ms		

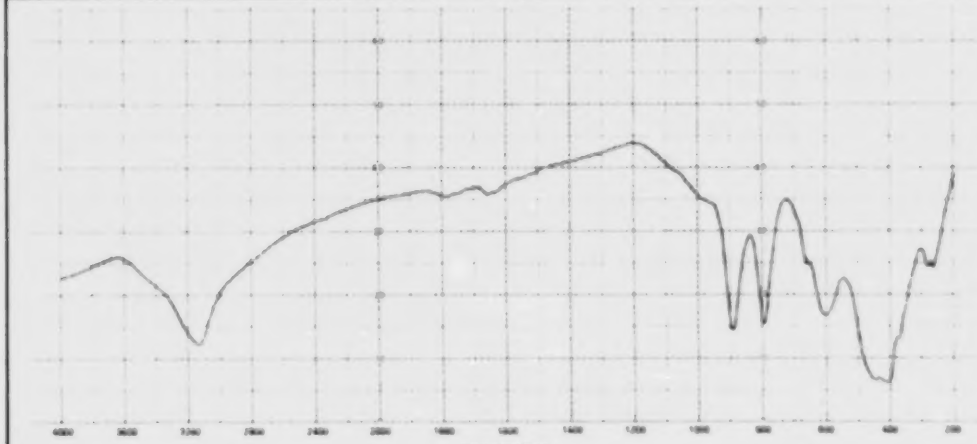
MINERAL NAME MAGNETITE	SUB GROUP	GROUP SPINEL	CLASS OXIDES	SPECTRA NO 309
CHEMICAL FORMULA (IDEAL) Fe⁺²Fe⁺³₂O₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP Fd3m (227)	a: 8.396 α:	b: β:	c: γ: Z: 8 D: 5.197
ORIGIN OF SAMPLE Kamaishi, Iwate, JAPAN	REMARKS	PARTICLE SIZE	CONC. 2 mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		
		D ₃ 570 mw 347 w		

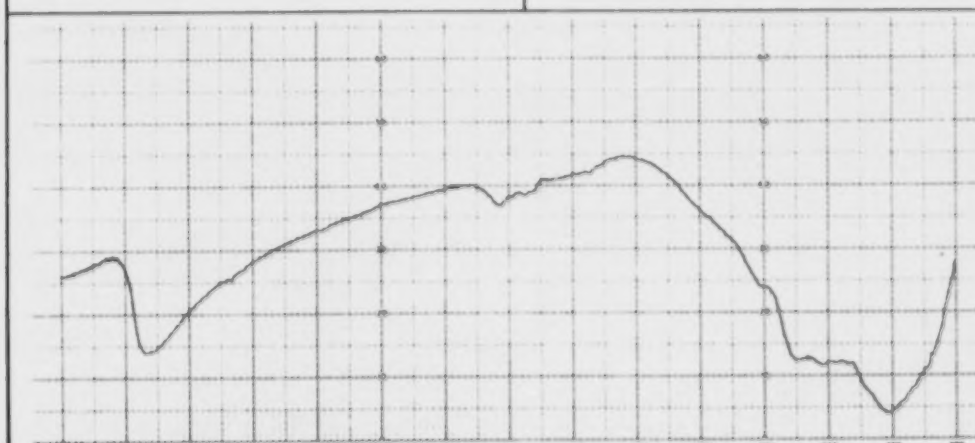
MINERAL NAME FRANKLINITE	SUB GROUP	GROUP SPINEL	CLASS OXIDES	SPECTRA NO 302
CHEMICAL FORMULA (IDEAL) ZnFe_2O_4		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP $\text{Fd}\bar{3}m(227)$	a: 8.4411 $\alpha:$	b: $\beta:$	c: $\gamma:$
		Z: 8	D: 5.324	
ORIGIN OF SAMPLE Franklin, NEW JERSEY USA	REMARKS		PARTICLE SIZE	CONC 2 mg
			MAJOR ABSORPTION BANDS (cm^{-1})	
			D D₃ 540 ms 396 ms 382 sh ms 372 sh ms	

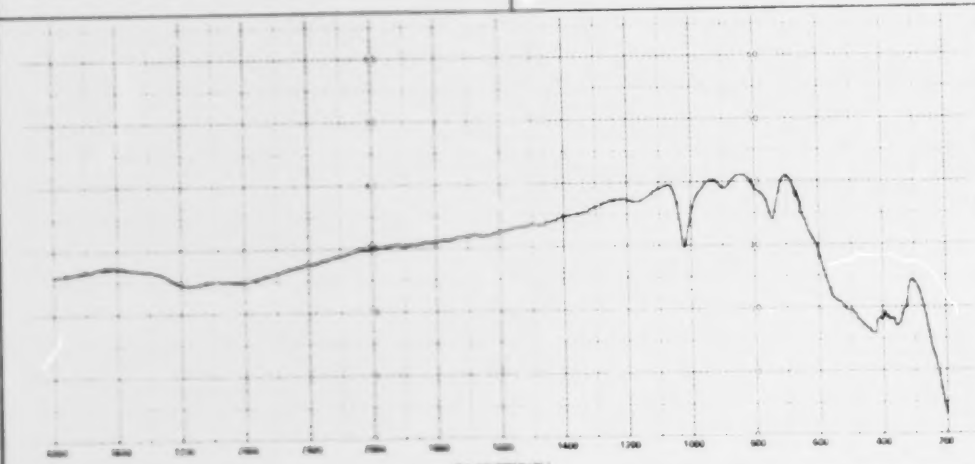
MINERAL NAME HAUSMANNITE	SUB GROUP	GROUP	CLASS OXIDES	SPECTRA NO A216
CHEMICAL FORMULA (IDEAL) $\text{Mn}^{+2}\text{Mn}_2^{+3}\text{O}_4$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP $14_1/\text{amd}(141)$	a: 5.76 $\alpha:$	b: $\beta:$	c: 9.44 $\gamma:$
		Z: 4	D: 4.84	
ORIGIN OF SAMPLE Synthetic	REMARKS		PARTICLE SIZE	CONC 1 mg
			MAJOR ABSORPTION BANDS (cm^{-1})	
			D D₂ 617 s 512 s 409 s D₃ 346 ms 320 sh	

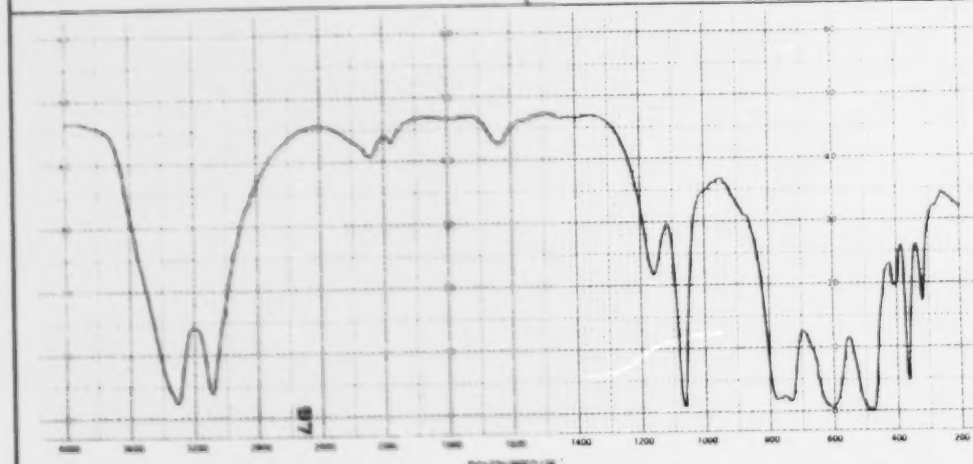
MINERAL NAME PSILONELANE	SUB GROUP	GROUP	CLASS OXIDES	SPECTRA NO 312									
CHEMICAL FORMULA (IDEAL) Mn oxides		CHEMICAL FORMULA (ACTUAL)											
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:									
ORIGIN OF SAMPLE Nsuta Gold Coast Colony	REMARKS		PARTICLE SIZE	CONC 1 mg									
			MAJOR ABSORPTION BANDS (cm ⁻¹)										
			<table> <tr> <td>D₂</td> <td>689</td> <td>ms</td> </tr> <tr> <td>D</td> <td>580</td> <td>s</td> </tr> <tr> <td>D₃</td> <td>532</td> <td>s</td> </tr> <tr> <td></td> <td>375</td> <td>m</td> </tr> </table>		D ₂	689	ms	D	580	s	D ₃	532	s
D ₂	689	ms											
D	580	s											
D ₃	532	s											
	375	m											

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																				
GOETHITE			OXYHYDROXIDES	290																																				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																						
α -FeO(OH)																																								
CRYSTAL SYSTEM	SPACE GROUP	a: 4.596	b: 9.957	c: 3.021																																				
ORTHORHOMBIC	Pbnm (62)	α :	β :	γ :																																				
				Z: 4																																				
				D: 4.264																																				
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																				
Biwabik, MINNESOTA, USA				1 mg																																				
				MAJOR ABSORPTION BANDS (cm⁻¹)																																				
				<table><tr><td>A</td><td>A₄</td><td>3135</td><td>ms</td></tr><tr><td>B</td><td>B₂</td><td>1785</td><td>w</td></tr><tr><td></td><td></td><td>1654</td><td>w</td></tr><tr><td></td><td></td><td>893</td><td>s</td></tr><tr><td></td><td>D₂</td><td>796</td><td>s</td></tr><tr><td></td><td></td><td>655</td><td>sh</td></tr><tr><td>D</td><td></td><td>605</td><td>ms</td></tr><tr><td></td><td></td><td>446</td><td>sh</td></tr><tr><td></td><td>D₃</td><td>405</td><td>s</td></tr><tr><td></td><td></td><td>372</td><td>sh</td></tr></table>	A	A ₄	3135	ms	B	B ₂	1785	w			1654	w			893	s		D ₂	796	s			655	sh	D		605	ms			446	sh		D ₃	405	s
A	A ₄	3135	ms																																					
B	B ₂	1785	w																																					
		1654	w																																					
		893	s																																					
	D ₂	796	s																																					
		655	sh																																					
D		605	ms																																					
		446	sh																																					
	D ₃	405	s																																					
		372	sh																																					

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
AKAGANEITE			OXYHYDROXIDES	286			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
β -FeO(OH)							
CRYSTAL SYSTEM	SPACE GROUP	a: 10.48	b:	c: 3.023			
TETRAGONAL	I4/m (95)	α :	β :	γ :			
				Z: 8			
				D: 3.555			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Synthetic				2 mg			
				MAJOR ABSORPTION BANDS (cm⁻¹)			
				A	A ₂	3460	ms
				B	B ₂	1620	w
				C		1548	w
					D ₂	790	sh m
		690	sh				
D		620	sh				
	D ₃	405	s				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO															
LEPIDOCROCITE			OXYHYDROXIDES	297															
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																	
$\gamma\text{-FeO(OH)}$																			
CRYSTAL SYSTEM	SPACE GROUP	a: 3.88	b: 12.54	c: 3.07															
ORTHORHOMBIC	Amam(63)	α :	β :	γ :															
				Z: 4															
				D: 3.95															
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.															
Rotlaufchen Giessen, GERMANY				1 mg															
			MAJOR ABSORPTION BANDS (cm^{-1})																
			<table><tr><td>D</td><td>1016</td><td>m</td></tr><tr><td>D₁</td><td>890</td><td>w</td></tr><tr><td>D₂</td><td>747</td><td>mw</td></tr><tr><td></td><td>540</td><td>sh</td></tr><tr><td>D₃</td><td>420</td><td>s</td></tr><tr><td></td><td>348</td><td></td></tr></table>		D	1016	m	D ₁	890	w	D ₂	747	mw		540	sh	D ₃	420	s
D	1016	m																	
D ₁	890	w																	
D ₂	747	mw																	
	540	sh																	
D ₃	420	s																	
	348																		

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																																	
BOEHMITE			OXYHYDROXIDES	A672																																																																	
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																																			
$\gamma\text{-AlO(OH)}$																																																																					
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																																																	
ORTHORHOMBIC	Amam (63)	3.700	12.227	2.868																																																																	
		α :	β :	γ :																																																																	
				Z: 4																																																																	
				D: 3.07																																																																	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.																																																																	
SMI 39 Synthetic, Aluminium Laboratories Ltd.				0.75 mg																																																																	
			MAJOR ABSORPTION BANDS (cm^{-1})																																																																		
			<table><tr><td>A</td><td>A₃</td><td>3310</td><td>s</td></tr><tr><td></td><td></td><td>3095</td><td>s</td></tr><tr><td></td><td>B₁</td><td>2090</td><td>w</td></tr><tr><td></td><td></td><td>1980</td><td>w</td></tr><tr><td>B</td><td>B₂</td><td>1640</td><td>w</td></tr><tr><td></td><td>D₁</td><td>1160</td><td>m</td></tr><tr><td></td><td></td><td>1070</td><td>s</td></tr><tr><td></td><td></td><td>880</td><td>w</td></tr><tr><td></td><td>D₂</td><td>775</td><td>sbr</td></tr><tr><td></td><td></td><td>735</td><td></td></tr><tr><td>D</td><td></td><td>610</td><td>msbr</td></tr><tr><td></td><td></td><td>495</td><td></td></tr><tr><td></td><td></td><td>480</td><td>msbr</td></tr><tr><td></td><td></td><td>410</td><td>mw</td></tr><tr><td>D₃</td><td></td><td>400</td><td>sh</td></tr><tr><td></td><td></td><td>368</td><td>ms</td></tr><tr><td></td><td></td><td>322</td><td>m</td></tr></table>		A	A ₃	3310	s			3095	s		B ₁	2090	w			1980	w	B	B ₂	1640	w		D ₁	1160	m			1070	s			880	w		D ₂	775	sbr			735		D		610	msbr			495				480	msbr			410	mw	D ₃		400	sh			368	ms	
A	A ₃	3310	s																																																																		
		3095	s																																																																		
	B ₁	2090	w																																																																		
		1980	w																																																																		
B	B ₂	1640	w																																																																		
	D ₁	1160	m																																																																		
		1070	s																																																																		
		880	w																																																																		
	D ₂	775	sbr																																																																		
		735																																																																			
D		610	msbr																																																																		
		495																																																																			
		480	msbr																																																																		
		410	mw																																																																		
D ₃		400	sh																																																																		
		368	ms																																																																		
		322	m																																																																		

MINERAL NAME DIASPORE	SUB GROUP	GROUP	CLASS OXYHYDROXIDES	SPECTRA NO. 294																																										
CHEMICAL FORMULA (IDEAL) α-AlO(OH)		CHEMICAL FORMULA (ACTUAL)																																												
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pbnm (62)	a: 4.396 α:	b: 9.426 β:	c: 2.844 γ:																																										
		Z: 4	D: 3.380																																											
ORIGIN OF SAMPLE Chester, MASSACHUSETTS, USA	REMARKS		PARTICLE SIZE	CONC. 2 mg																																										
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																											
			<table> <tr> <td rowspan="3">B</td> <td>B₁</td> <td>2990</td> <td>sh</td> <td>ms</td> </tr> <tr> <td></td> <td>2910</td> <td></td> <td></td> </tr> <tr> <td></td> <td>2109</td> <td></td> <td>m</td> </tr> <tr> <td></td> <td>B₂</td> <td>1498</td> <td></td> <td>m</td> </tr> <tr> <td rowspan="6">D</td> <td rowspan="2">D₁</td> <td>1068</td> <td></td> <td>ms</td> </tr> <tr> <td>960</td> <td></td> <td>s</td> </tr> <tr> <td rowspan="2">D₂</td> <td>747</td> <td></td> <td>ms</td> </tr> <tr> <td>664</td> <td></td> <td>mw</td> </tr> <tr> <td rowspan="2">D₃</td> <td>570</td> <td></td> <td>s</td> </tr> <tr> <td>514</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>339</td> <td></td> <td>s</td> </tr> </table>		B	B ₁	2990	sh	ms		2910				2109		m		B ₂	1498		m	D	D ₁	1068		ms	960		s	D ₂	747		ms	664		mw	D ₃	570		s	514		w		
B	B ₁	2990	sh	ms																																										
		2910																																												
		2109		m																																										
	B ₂	1498		m																																										
D	D ₁	1068		ms																																										
		960		s																																										
	D ₂	747		ms																																										
		664		mw																																										
	D ₃	570		s																																										
		514		w																																										
		339		s																																										

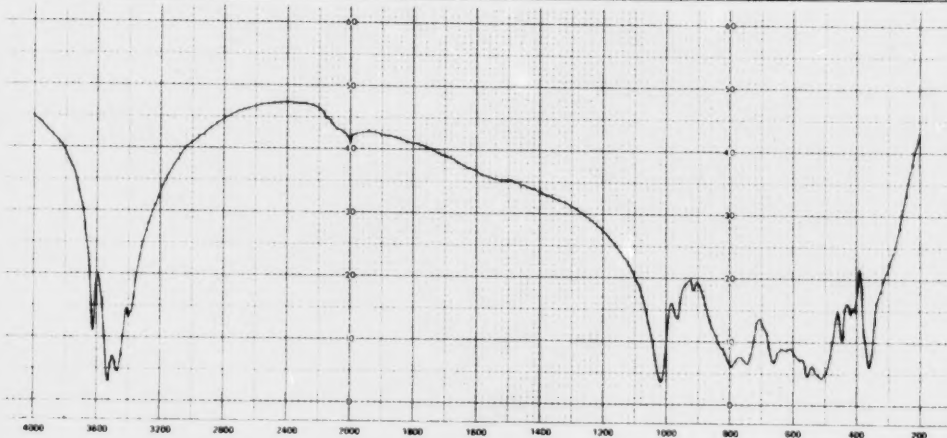
MINERAL NAME MANGANITE	SUB GROUP	GROUP	CLASS OXYHYDROXIDES	SPECTRA NO. 307																											
CHEMICAL FORMULA (IDEAL) MnO(OH)		CHEMICAL FORMULA (ACTUAL)																													
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP B2₁/d(14)	a: 8.94 α:	b: 5.28 β: $\approx 90^\circ$	c: 5.74 γ:																											
		Z: 8	D: 4.30																												
ORIGIN OF SAMPLE Jackson Mine, Nagaunee, MICHIGAN USA	REMARKS		PARTICLE SIZE	CONC. 1.5 mg																											
			MAJOR ABSORPTION BANDS (cm ⁻¹)																												
			<table> <tr> <td rowspan="3">D₁</td> <td></td> <td>1148</td> <td></td> <td>mw</td> </tr> <tr> <td></td> <td>1113</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td>1083</td> <td></td> <td>m</td> </tr> <tr> <td rowspan="4">D</td> <td></td> <td>592</td> <td></td> <td>s</td> </tr> <tr> <td rowspan="2">D₃</td> <td>501</td> <td></td> <td>ms</td> </tr> <tr> <td>443</td> <td></td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>347</td> <td></td> <td>ms</td> </tr> </table>		D ₁		1148		mw		1113		w		1083		m	D		592		s	D ₃	501		ms	443		m		
D ₁		1148		mw																											
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D		592		s																											
	D ₃	501		ms																											
		443		m																											
			347		ms																										

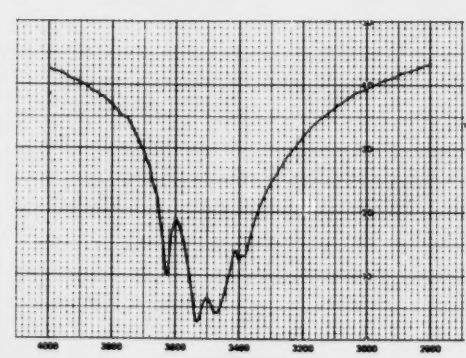
MINERAL NAME BRUCITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO. 317																																				
CHEMICAL FORMULA (IDEAL) Mg(OH)₂		CHEMICAL FORMULA (ACTUAL)																																						
CRYSTAL SYSTEM HEXAGONAL (TRIGONAL)	SPACE GROUP P$\bar{3}$m1 (164)	a: 3.147 α:	b: β:	c: 4.769 γ: Z: 1 D: 2.37																																				
ORIGIN OF SAMPLE Jeffrey Mine, Johnsmantown Asbestos, QUEBEC, CANADA		REMARKS		PARTICLE SIZE CONC. 1 mg																																				
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3700</td> <td>S</td> </tr> <tr> <td></td> <td>A₂</td> <td>3450</td> <td>mw</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1625</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>1073</td> <td>w</td> </tr> <tr> <td></td> <td>D₁</td> <td>1015</td> <td>w</td> </tr> <tr> <td>D</td> <td></td> <td>950</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>540</td> <td>sh</td> </tr> <tr> <td></td> <td>D₁</td> <td>440</td> <td>S</td> </tr> <tr> <td></td> <td></td> <td>356</td> <td>S</td> </tr> </table>	A	A ₁	3700	S		A ₂	3450	mw	B	B ₂	1625	w			1073	w		D ₁	1015	w	D		950	mw			540	sh		D ₁	440	S			356	S
A	A ₁	3700	S																																					
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B	B ₂	1625	w																																					
		1073	w																																					
	D ₁	1015	w																																					
D		950	mw																																					
		540	sh																																					
	D ₁	440	S																																					
		356	S																																					

MINERAL NAME PYROCHROITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO. 296									
CHEMICAL FORMULA (IDEAL) Mn(OH)₂		CHEMICAL FORMULA (ACTUAL)											
CRYSTAL SYSTEM TRIGONAL (?)	SPACE GROUP P$\bar{3}$m1 (164) (?)	a: 3.34 α:	b: β:	c: 4.68 γ: Z: 1 D: 3.25									
ORIGIN OF SAMPLE Iwate, JAPAN		REMARKS		PARTICLE SIZE CONC. 2.5 mg									
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="1"> <tr> <td>D₁</td> <td>975</td> <td>mw</td> </tr> <tr> <td>D₂</td> <td>605</td> <td>ms</td> </tr> <tr> <td>D₃</td> <td>494</td> <td>S</td> </tr> </table>	D ₁	975	mw	D ₂	605	ms	D ₃	494	S
D ₁	975	mw											
D ₂	605	ms											
D ₃	494	S											

MINERAL NAME PORTLANDITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO 315												
CHEMICAL FORMULA (IDEAL) Ca(OH)₂		CHEMICAL FORMULA (ACTUAL)														
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP P$\bar{3}$m1 (164)	a: 3.593 α :	b: β :	c: 4.909 γ : Z: 1 D: 2.241												
ORIGIN OF SAMPLE Bellerberg, Eiffel, GERMANY	REMARKS	PARTICLE SIZE	CONC 2 mg													
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3650</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₄</td> <td>398</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>301</td> <td>s</td> </tr> </table>	A	A ₁	3650	s	D	D ₄	398	ms			301	s
A	A ₁	3650	s													
D	D ₄	398	ms													
		301	s													

MINERAL NAME FERRIHYDRITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO 321																																				
CHEMICAL FORMULA (IDEAL) Fe₁₀O₁₅-9H₂O		CHEMICAL FORMULA (ACTUAL)																																						
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP (?) ()	a: 5.08 α :	b: β :	c: 9.4 γ : Z: D: 3.96																																				
ORIGIN OF SAMPLE Synthetic	REMARKS	PARTICLE SIZE	CONC 1.6 mg																																					
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="1"> <tr> <td>A</td> <td>A₃</td> <td>3400</td> <td>s</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1688</td> <td>s</td> </tr> <tr> <td>C</td> <td></td> <td>1413</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>1295</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1117</td> <td>mw</td> </tr> <tr> <td>D</td> <td></td> <td>1048</td> <td>w</td> </tr> <tr> <td></td> <td>D₂</td> <td>785</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>685</td> <td>mw</td> </tr> <tr> <td></td> <td>D₃</td> <td>390</td> <td>ms</td> </tr> </table>	A	A ₃	3400	s	B	B ₂	1688	s	C		1413	m			1295	mw		D ₁	1117	mw	D		1048	w		D ₂	785	w			685	mw		D ₃	390	ms
A	A ₃	3400	s																																					
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		685	mw																																					
	D ₃	390	ms																																					

MINERAL NAME GIBBSITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO A215																																								
CHEMICAL FORMULA (IDEAL) $\alpha\text{-Al(OH)}_3$		CHEMICAL FORMULA (ACTUAL)																																										
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $P2_1/n(14)$	a: 8.641 α:	b: 5.070 β: 94°34'	c: 9.719 γ:																																								
		Z: 8	D: 2.44																																									
ORIGIN OF SAMPLE Wingellina, Hinckley Range, W. AUSTRALIA	REMARKS	PARTICLE SIZE	CONC 2 mg																																									
		MAJOR ABSORPTION BANDS (cm⁻¹)																																										
		<table border="0"> <tr> <td>A₁</td> <td>3633</td> <td>ms</td> </tr> <tr> <td rowspan="3">A</td> <td>3538</td> <td></td> </tr> <tr> <td>3478</td> <td>s</td> </tr> <tr> <td>3402</td> <td></td> </tr> <tr> <td>A₃</td> <td>3387</td> <td>sh</td> </tr> <tr> <td rowspan="3">D₁</td> <td>1017</td> <td>s</td> </tr> <tr> <td>964</td> <td>mw</td> </tr> <tr> <td>911</td> <td></td> </tr> <tr> <td rowspan="3">D₂</td> <td>795</td> <td></td> </tr> <tr> <td>746</td> <td>ms</td> </tr> <tr> <td>663</td> <td></td> </tr> <tr> <td rowspan="4">D₃</td> <td>554</td> <td></td> </tr> <tr> <td>510</td> <td>s</td> </tr> <tr> <td>446</td> <td></td> </tr> <tr> <td>418</td> <td></td> </tr> <tr> <td></td> <td>406</td> <td>mw</td> </tr> <tr> <td></td> <td>360</td> <td>s</td> </tr> </table>			A ₁	3633	ms	A	3538		3478	s	3402		A ₃	3387	sh	D ₁	1017	s	964	mw	911		D ₂	795		746	ms	663		D ₃	554		510	s	446		418			406	mw	
A ₁	3633	ms																																										
A	3538																																											
	3478	s																																										
	3402																																											
A ₃	3387	sh																																										
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	510	s																																										
	446																																											
	418																																											
	406	mw																																										
	360	s																																										

MINERAL NAME GIBBSITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO A215¹
CHEMICAL FORMULA (IDEAL) $\alpha\text{-Al(OH)}_3$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
		Z:	D:	
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		

MINERAL NAME BAYERITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO 291																																															
CHEMICAL FORMULA (IDEAL) β-Al(OH)₃		CHEMICAL FORMULA (ACTUAL)																																																	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP P2₁/a (14)	a: 5.062 α:	b: 8.671 β: 90.27°	c: 4.713 γ:																																															
		Z: 4	D: 2.504																																																
ORIGIN OF SAMPLE Synthetic	REMARKS		PARTICLE SIZE	CONC 1 mg																																															
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																
			<table border="0"> <tr> <td rowspan="5">A</td> <td>A₁</td> <td>3662</td> <td>ms</td> </tr> <tr> <td></td> <td>3628</td> <td>sh</td> </tr> <tr> <td></td> <td>3557</td> <td>ms</td> </tr> <tr> <td>A₂</td> <td>3538</td> <td>sh</td> </tr> <tr> <td></td> <td>3467</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>3441</td> <td>sh</td> </tr> <tr> <td rowspan="3">D₁</td> <td></td> <td>1021)</td> <td>s</td> </tr> <tr> <td></td> <td>975)</td> <td>mw</td> </tr> <tr> <td></td> <td>775)</td> <td>s</td> </tr> <tr> <td rowspan="3">D₂</td> <td></td> <td>718)</td> <td>sh</td> </tr> <tr> <td></td> <td>610)</td> <td>sh</td> </tr> <tr> <td></td> <td>532)</td> <td>s</td> </tr> <tr> <td rowspan="3">D₃</td> <td></td> <td>468)</td> <td>mw</td> </tr> <tr> <td></td> <td>422)</td> <td>mw</td> </tr> <tr> <td></td> <td>371)</td> <td>mw</td> </tr> </table>		A	A ₁	3662	ms		3628	sh		3557	ms	A ₂	3538	sh		3467	s			3441	sh	D ₁		1021)	s		975)	mw		775)	s	D ₂		718)	sh		610)	sh		532)	s	D ₃		468)	mw		422)	mw
A	A ₁	3662	ms																																																
		3628	sh																																																
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D ₂		718)	sh																																																
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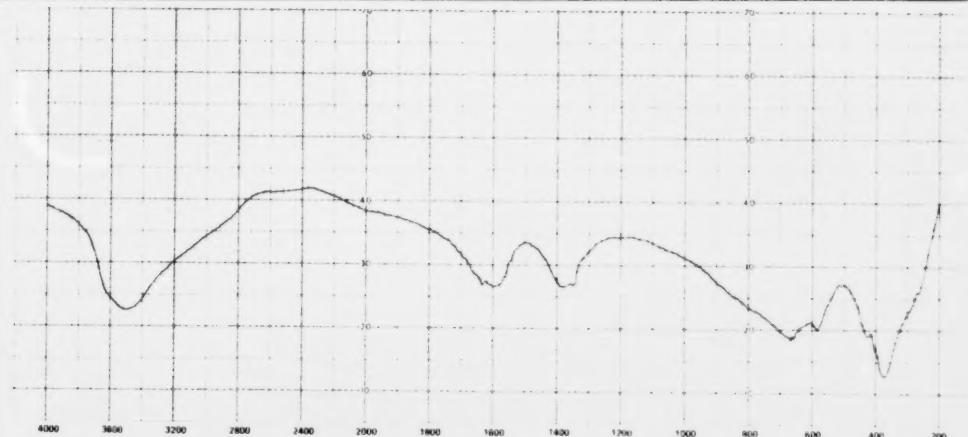
MINERAL NAME BAYERITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO 291¹
CHEMICAL FORMULA (IDEAL) β-Al(OH)₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
		Z:	D:	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

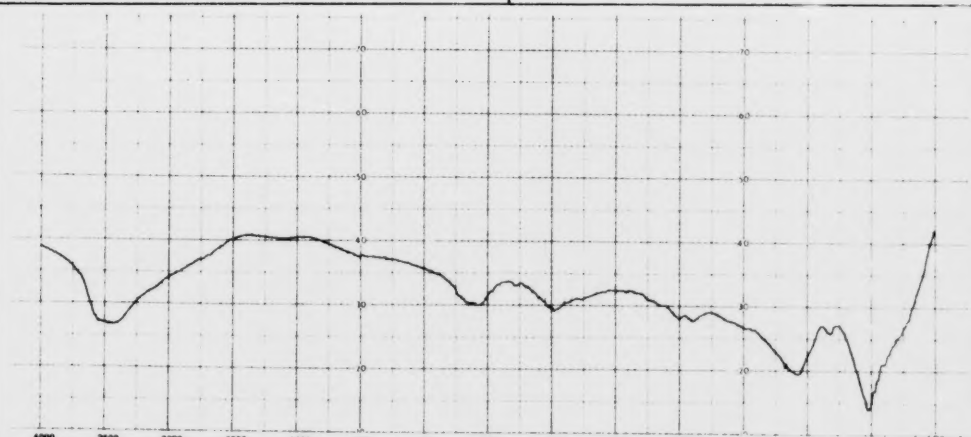
MINERAL NAME NORDSTRANDITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO A213																																															
CHEMICAL FORMULA (IDEAL) $\gamma\text{-Al(OH)}_3$		CHEMICAL FORMULA (ACTUAL)																																																	
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP (?)	a: 8.893 b: 10.237 c: 5.004 α : 92°56' β : 90°32' γ : 110°23' Z: 8 D: 2.43																																																	
ORIGIN OF SAMPLE Synthetic	REMARKS	PARTICLE SIZE	CONC 1 mg																																																
		MAJOR ABSORPTION BANDS (cm⁻¹)																																																	
		<table> <tr><td>A₁</td><td>3662</td><td>sh</td></tr> <tr><td></td><td>3638</td><td>ms</td></tr> <tr><td></td><td>3577</td><td></td></tr> <tr><td>A</td><td>A₂</td><td>3542</td><td>s</td></tr> <tr><td></td><td></td><td>3515</td><td></td></tr> <tr><td></td><td></td><td>3485</td><td>sh</td></tr> <tr><td></td><td></td><td>3440</td><td>m</td></tr> <tr><td></td><td>A₃</td><td>3381</td><td></td></tr> <tr><td>B</td><td>B₂</td><td>1628</td><td></td></tr> <tr><td></td><td></td><td>1057</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>1003</td><td></td></tr> <tr><td></td><td></td><td>968</td><td>s</td></tr> <tr><td></td><td></td><td>913</td><td>mw</td></tr> </table>			A ₁	3662	sh		3638	ms		3577		A	A ₂	3542	s			3515				3485	sh			3440	m		A ₃	3381		B	B ₂	1628				1057	ms		D ₁	1003				968	s		
A ₁	3662	sh																																																	
	3638	ms																																																	
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A	A ₂	3542	s																																																
		3515																																																	
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		3440	m																																																
	A ₃	3381																																																	
B	B ₂	1628																																																	
		1057	ms																																																
	D ₁	1003																																																	
		968	s																																																
		913	mw																																																

MINERAL NAME NORDSTRANDITE	SUB GROUP	GROUP	CLASS HYDROXIDES	SPECTRA NO A213 ¹																																		
CHEMICAL FORMULA (IDEAL) $\gamma\text{-Al(OH)}_3$		CHEMICAL FORMULA (ACTUAL)																																				
CRYSTAL SYSTEM	SPACE GROUP ()	a:	b:	c:																																		
		α :	β :	γ :																																		
		Z:	D:																																			
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg																																			
		MAJOR ABSORPTION BANDS (cm⁻¹)																																				
		<table> <tr><td></td><td>822</td><td>sh</td></tr> <tr><td>D₂</td><td>739</td><td>s</td></tr> <tr><td></td><td>663</td><td>w</td></tr> <tr><td>D</td><td>615</td><td>w</td></tr> <tr><td></td><td>530</td><td></td></tr> <tr><td></td><td>510</td><td>s</td></tr> <tr><td></td><td>457</td><td>mw</td></tr> <tr><td>D₃</td><td>426</td><td>w</td></tr> <tr><td></td><td>407</td><td>ms</td></tr> <tr><td></td><td>369</td><td>sh</td></tr> <tr><td></td><td>355</td><td>ms</td></tr> <tr><td></td><td>321</td><td>mw</td></tr> </table>				822	sh	D ₂	739	s		663	w	D	615	w		530			510	s		457	mw	D ₃	426	w		407	ms		369	sh		355	ms	
	822	sh																																				
D ₂	739	s																																				
	663	w																																				
D	615	w																																				
	530																																					
	510	s																																				
	457	mw																																				
D ₃	426	w																																				
	407	ms																																				
	369	sh																																				
	355	ms																																				
	321	mw																																				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																													
SASSOLITE			HYDROXIDES	318																																													
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																															
H_3BO_3 or $B(OH)_3$																																																	
CRYSTAL SYSTEM	SPACE GROUP	a: 7.05 α : 92°30'	b: 7.05 β : 101°10'	c: 6.57 γ : 120°																																													
TRICLINIC	$P\bar{1}$ (2)	Z: 4		D: 1.48																																													
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																													
Lagoons of Tuscany, ITALY				2 mg																																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																																														
			<table border="0"> <tr> <td>A</td> <td>A₃</td> <td>3225</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>2515</td> <td>w</td> </tr> <tr> <td>B</td> <td>B₁</td> <td>2360</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>2260</td> <td>mw</td> </tr> <tr> <td>C</td> <td></td> <td>1450</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>1190</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>880</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>808</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>740</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>670</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>638</td> <td>m</td> </tr> <tr> <td></td> <td>D₃</td> <td>542</td> <td>ms</td> </tr> </table>		A	A ₃	3225	s			2515	w	B	B ₁	2360	w			2260	mw	C		1450	s		D ₁	1190	s			880	mw			808	ms	D	D ₂	740	sh			670	w			638	m	
A	A ₃	3225	s																																														
		2515	w																																														
B	B ₁	2360	w																																														
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C		1450	s																																														
	D ₁	1190	s																																														
		880	mw																																														
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D	D ₂	740	sh																																														
		670	w																																														
		638	m																																														
	D ₃	542	ms																																														

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α :	β :	γ :
		Z:		D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
				mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
PYROAURITE		HYDROTALCITE	HYDROXY-CARBONATES	311		
		CHEMICAL FORMULA (IDEAL)	CHEMICAL FORMULA (ACTUAL)			
		Mg ₆ Fe ₂ ⁺³ (CO ₃)(OH) ₁₆ ·4H ₂ O				
CRYSTAL SYSTEM	SPACE GROUP					
TRIGONAL	R $\bar{3}$ m (?) a: 6.19 b: c: 46.54 Z: 3 D: 2.12 α: β: γ:					
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
^O Långban, SWEDEN				2.5 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₂	3500	s
			B	B ₂	1600	ms
			C		1380	ms
				D ₂	666	ms
			D		580	mw
				D ₃	422	
					370	s
			WAVENUMBER CM ⁻¹			

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
STICHTITE		HYDROTALCITE	HYDROXY-CARBONATES	285		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
Mg ₆ Cr ₂ (CO ₃)(OH) ₁₆ ·4H ₂ O						
CRYSTAL SYSTEM	SPACE GROUP	a: 6.18 α:	b: β:	c: 46.38 γ:		
TRIGONAL or HEXAGONAL	(?)			Z: 3 D: 2.11		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
Dundas, TASMANIA				2 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₂	3540	ms
			B	B ₂	1655	mw
			C		1385	mw
				D ₁	996	w
					952	
			D	D ₂	620	ms
					520	w
				D ₃	403	s

MINERAL NAME MANASSEITE	SUB GROUP	GROUP II SJOGRENITE	CLASS HYDROXY-CARBONATES	SPECTRA NO 325																																
CHEMICAL FORMULA (IDEAL) $Mg_6Al_2(CO_3)(OH)_{16} \cdot 4H_2O$		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP (?)	a: 6.12 α:	b: β:	c: 15.34 γ: Z: 1 D: 2.00																																
ORIGIN OF SAMPLE Snarum, NORWAY	REMARKS		PARTICLE SIZE	CONC 2 mg																																
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																	
			<table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3600</td> <td>sh</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>3518</td> <td></td> <td></td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1656</td> <td></td> <td>m</td> </tr> <tr> <td>C</td> <td></td> <td>1373</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td>D₂</td> <td>650</td> <td></td> <td>s</td> </tr> <tr> <td>D</td> <td>D₃</td> <td>550</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>410</td> <td></td> <td>s</td> </tr> </table>		A	A ₂	3600	sh	s			3518			B	B ₂	1656		m	C		1373		ms		D ₂	650		s	D	D ₃	550		w		
A	A ₂	3600	sh	s																																
		3518																																		
B	B ₂	1656		m																																
C		1373		ms																																
	D ₂	650		s																																
D	D ₃	550		w																																
		410		s																																

MINERAL NAME BARBERTONITE	SUB GROUP	GROUP II SJOGRENITE	CLASS HYDROXY-CARBONATES	SPECTRA NO 293																																
CHEMICAL FORMULA (IDEAL) $Mg_6Cr_2(CO_3)(OH)_{16} \cdot 4H_2O$		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP (?)	a: 6.17 α:	b: β:	c: 15.52 γ: Z: 1 D: 2.11																																
ORIGIN OF SAMPLE Barberton, Transvaal, AFRICA	REMARKS		PARTICLE SIZE	CONC 2 mg																																
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																	
			<table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3620</td> <td>sh</td> <td></td> </tr> <tr> <td></td> <td>A₂</td> <td>3525</td> <td></td> <td>s</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1650</td> <td></td> <td>ms</td> </tr> <tr> <td>C</td> <td></td> <td>1390</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td>D₂</td> <td>655</td> <td></td> <td>s</td> </tr> <tr> <td>D</td> <td></td> <td>610</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>398</td> <td></td> <td>s</td> </tr> </table>		A	A ₁	3620	sh			A ₂	3525		s	B	B ₂	1650		ms	C		1390		ms		D ₂	655		s	D		610		ms		D ₃
A	A ₁	3620	sh																																	
	A ₂	3525		s																																
B	B ₂	1650		ms																																
C		1390		ms																																
	D ₂	655		s																																
D		610		ms																																
	D ₃	398		s																																

MINERAL NAME BRUGNATELLITE	SUB GROUP	GROUP	CLASS HYDROXY-CARBONATES	SPECTRA NO 323																																	
CHEMICAL FORMULA (IDEAL) $\text{Mg}_6\text{Fe}^{+3}(\text{CO}_3)(\text{OH})_{13} \cdot 4\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																			
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP (?)	a: 5.47 α:	b: β:	c: 15.97 γ: Z: 1 D: 2.21																																	
ORIGIN OF SAMPLE Cave Del Creston Torre S. Maria, ITALY	REMARKS		PARTICLE SIZE	CONC 1.5 mg																																	
			MAJOR ABSORPTION BANDS (cm^{-1})																																		
			<table border="0"> <tr><td>A</td><td>A₂</td><td>3470</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1628</td><td>ms</td></tr> <tr><td>C</td><td>C</td><td>1360</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>1068</td><td>w</td></tr> <tr><td></td><td></td><td>942</td><td>mw</td></tr> <tr><td></td><td>D₂</td><td>653</td><td></td></tr> <tr><td></td><td></td><td>580</td><td>ms</td></tr> <tr><td>D</td><td></td><td>415</td><td>sh</td></tr> <tr><td></td><td>D₃</td><td>368</td><td>s</td></tr> </table>		A	A ₂	3470	s	B	B ₂	1628	ms	C	C	1360	ms		D ₁	1068	w			942	mw		D ₂	653				580	ms	D		415	sh	
A	A ₂	3470	s																																		
B	B ₂	1628	ms																																		
C	C	1360	ms																																		
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	D ₃	368	s																																		

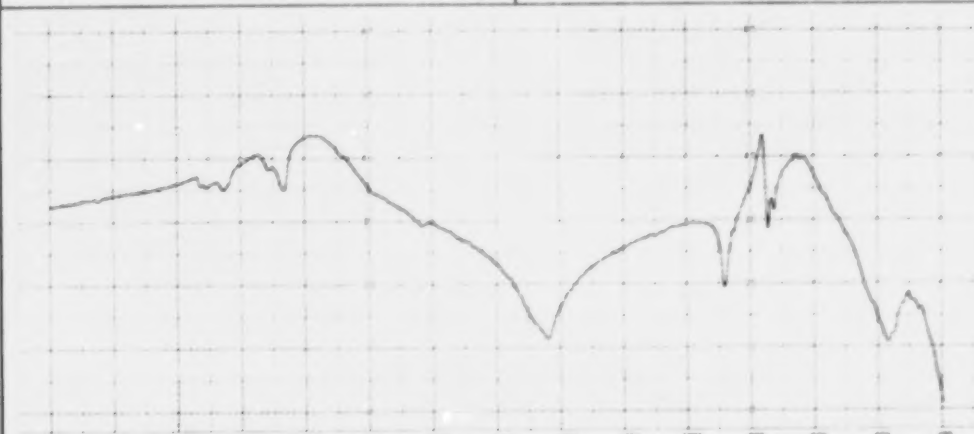
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

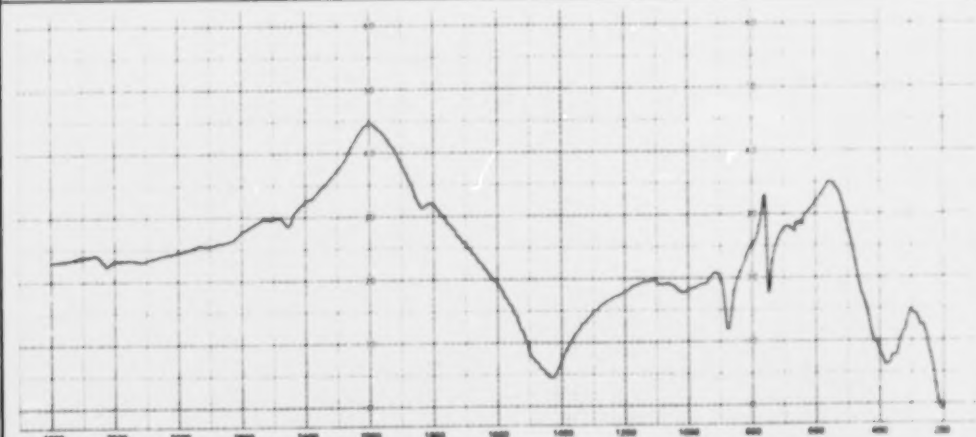
MINERAL NAME CALCITE	SUB GROUP CALCITE- RHODOCHROSITE	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO 235																											
CHEMICAL FORMULA (IDEAL) CaCO₃		CHEMICAL FORMULA (ACTUAL)																													
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R$\bar{3}$c (167) a: 4.989 b: c: 17.062 Z: 6 D: 2.711 α: β: γ:																														
ORIGIN OF SAMPLE Chihuahua, MEXICO	REMARKS a_{rh}: 6.36, α: 46° 06' Z: 2		PARTICLE SIZE	CONC 4 mg																											
			MAJOR ABSORPTION BANDS (cm ⁻¹)																												
			<table border="0"> <tr><td></td><td>2980</td><td>mw</td></tr> <tr><td></td><td>2873</td><td>mw</td></tr> <tr><td>B</td><td>B₁ 2580</td><td>sh w</td></tr> <tr><td></td><td>2513</td><td>mw</td></tr> <tr><td></td><td>B₂ 1800</td><td>ms</td></tr> <tr><td>C</td><td>1420</td><td>s</td></tr> <tr><td></td><td>874</td><td>s</td></tr> <tr><td>D</td><td>D₂ 845</td><td>sh m</td></tr> <tr><td></td><td>710</td><td>ms</td></tr> <tr><td></td><td>D₃ 293</td><td>s</td></tr> </table>			2980	mw		2873	mw	B	B ₁ 2580	sh w		2513	mw		B ₂ 1800	ms	C	1420	s		874	s	D	D ₂ 845	sh m		710	ms
	2980	mw																													
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D	D ₂ 845	sh m																													
	710	ms																													
	D ₃ 293	s																													

MINERAL NAME CALCITE	SUB GROUP	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO 235¹
CHEMICAL FORMULA (IDEAL) CaCO₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME SIDERITE	SUB GROUP	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO. 236																																					
CHEMICAL FORMULA (IDEAL) FeCO_3		CHEMICAL FORMULA (ACTUAL)																																							
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $R\bar{3}c$ (167)	a: 4.688 α :	b: β :	c: 15.375 γ : Z: 6 D: 3.944																																					
ORIGIN OF SAMPLE GREENLAND	REMARKS $a_{rh}: 5.796, \alpha: 47^\circ 43', Z: 2$		PARTICLE SIZE	CONC 4 mg																																					
			MAJOR ABSORPTION BANDS (μm)																																						
			<table border="0"> <tr> <td>B</td> <td>B₁</td> <td>2950</td> <td></td> </tr> <tr> <td></td> <td></td> <td>2860</td> <td></td> </tr> <tr> <td></td> <td></td> <td>2495</td> <td>w</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1815</td> <td>w</td> </tr> <tr> <td>C</td> <td></td> <td>1410</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>863</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₁</td> <td>830</td> <td>sh mw</td> </tr> <tr> <td></td> <td></td> <td>733</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>315</td> <td></td> </tr> <tr> <td>D</td> <td>D₂</td> <td>295</td> <td>s</td> </tr> </table>		B	B ₁	2950				2860				2495	w	B	B ₂	1815	w	C		1410	s			863	s	D	D ₁	830	sh mw			733	ms			315		D
B	B ₁	2950																																							
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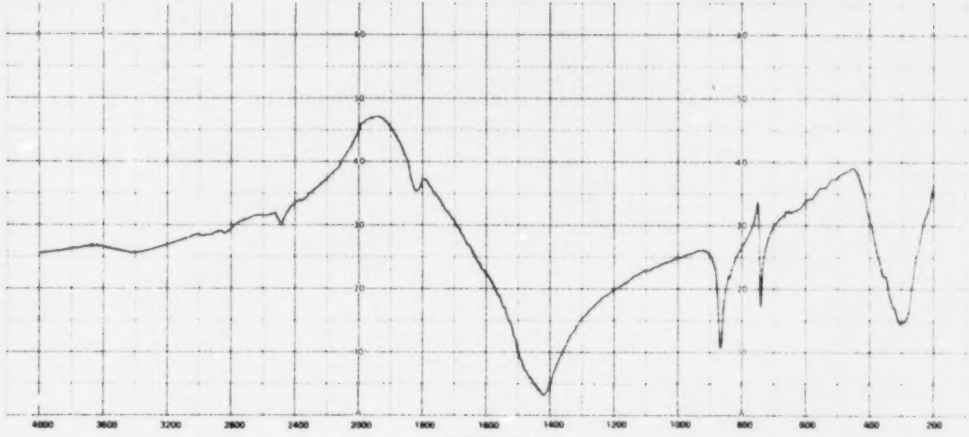
MINERAL NAME SIDERITE	SUB GROUP	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO. 236 ¹
CHEMICAL FORMULA (IDEAL) FeCO_3		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (μm)	

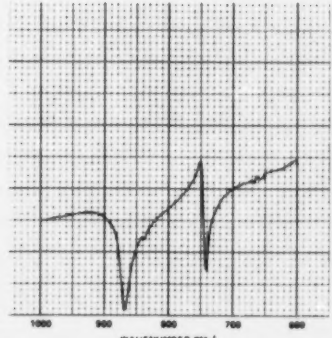
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																								
MAGNESITE		CALCITE	CARBONATES	245																																								
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																										
MgCO ₃																																												
CRYSTAL SYSTEM	SPACE GROUP	a: 4.6332	b:	c: 15.015																																								
TRIGONAL	R $\bar{3}$ c (167)	α :	β :	γ :																																								
		Z: 6																																										
		D: 3.009																																										
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																								
Kilmar, QUEBEC, CANADA	a _{rh} : 5.61, α : 48° 10' Z: 2			4 mg																																								
				MAJOR ABSORPTION BANDS (cm ⁻¹)																																								
				<table><tr><td>A</td><td>A_g</td><td>3055)</td><td>W</td></tr><tr><td></td><td></td><td>3018)</td><td></td></tr><tr><td></td><td></td><td>2095</td><td>W</td></tr><tr><td></td><td>B₁</td><td>2630)</td><td>W</td></tr><tr><td></td><td></td><td>2532)</td><td>mw</td></tr><tr><td>B</td><td>B₂</td><td>1830</td><td>mw</td></tr><tr><td>C</td><td></td><td>1438</td><td>S</td></tr><tr><td></td><td></td><td>881</td><td>ms</td></tr><tr><td></td><td>D₂</td><td>851</td><td>sh</td></tr><tr><td>D</td><td></td><td>745</td><td>m</td></tr><tr><td></td><td>D₃</td><td>367</td><td>S</td></tr></table>	A	A _g	3055)	W			3018)				2095	W		B ₁	2630)	W			2532)	mw	B	B ₂	1830	mw	C		1438	S			881	ms		D ₂	851	sh	D		745	m
A	A _g	3055)	W																																									
		3018)																																										
		2095	W																																									
	B ₁	2630)	W																																									
		2532)	mw																																									
B	B ₂	1830	mw																																									
C		1438	S																																									
		881	ms																																									
	D ₂	851	sh																																									
D		745	m																																									
	D ₃	367	S																																									

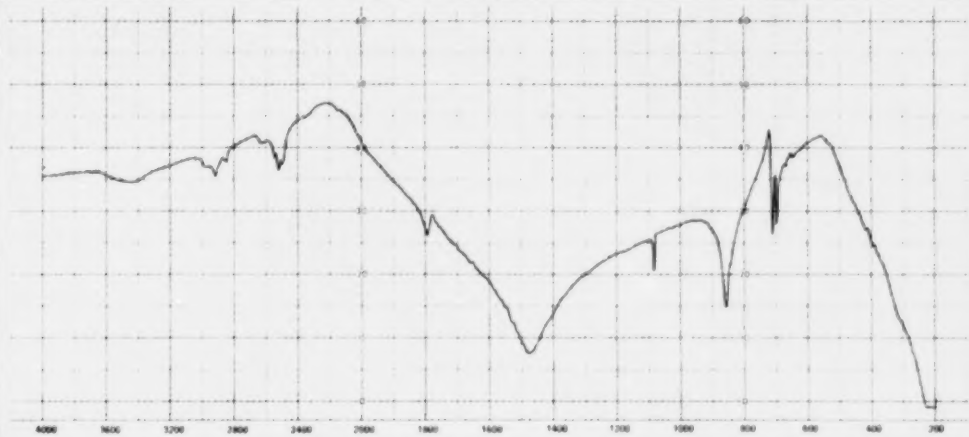
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																				
GASPÉITE		CALCITE	CARBONATES	246																				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																						
(Ni, Mg, Fe)CO ₃																								
CRYSTAL SYSTEM	SPACE GROUP	a: 4.621	b:	c: 14.93																				
TRIGONAL	R $\bar{3}$ m (166)	α :	β :	Z: 6																				
			γ :	D: 3.748																				
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																				
Gaspe, QUEBEC, CANADA				4 mg																				
				MAJOR ABSORPTION BANDS (cm ⁻¹)																				
				<table><tr><td>B</td><td>B₁</td><td>2510</td><td>W</td></tr><tr><td></td><td>B₂</td><td>1830</td><td>mw</td></tr><tr><td>C</td><td></td><td>1425</td><td>S</td></tr><tr><td></td><td></td><td>872</td><td>S</td></tr><tr><td></td><td>D₂</td><td>747</td><td>ms</td></tr><tr><td>D</td><td></td><td>380</td><td>S</td></tr></table>	B	B ₁	2510	W		B ₂	1830	mw	C		1425	S			872	S		D ₂	747	ms
B	B ₁	2510	W																					
	B ₂	1830	mw																					
C		1425	S																					
		872	S																					
	D ₂	747	ms																					
D		380	S																					

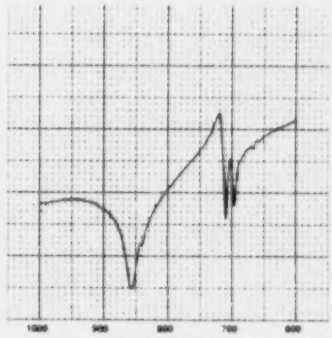
MINERAL NAME RHODOCHROSITE	SUB GROUP	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO 234																																															
CHEMICAL FORMULA (IDEAL) MnCO₃		CHEMICAL FORMULA (ACTUAL)																																																	
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R$\bar{3}$c (167)	a: 4.739 α :	b: β :	c: 15.541 γ : Z: 6 D: 3.70																																															
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC 4 mg																																															
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																
			<table> <tr><td>B</td><td>B₁</td><td>2965</td><td>sh</td><td>w</td></tr> <tr><td></td><td></td><td>2925</td><td></td><td>w</td></tr> <tr><td></td><td></td><td>(2590)</td><td></td><td>w</td></tr> <tr><td></td><td></td><td>2487</td><td></td><td>w</td></tr> <tr><td></td><td>B₂</td><td>1808</td><td></td><td>mw</td></tr> <tr><td>C</td><td></td><td>1410</td><td></td><td>ms</td></tr> <tr><td></td><td></td><td>863</td><td></td><td>ms</td></tr> <tr><td>D</td><td>D₂</td><td>832</td><td>sh</td><td>m</td></tr> <tr><td></td><td></td><td>721</td><td></td><td>m</td></tr> <tr><td></td><td>D₃</td><td>304</td><td></td><td>ms</td></tr> </table>		B	B ₁	2965	sh	w			2925		w			(2590)		w			2487		w		B ₂	1808		mw	C		1410		ms			863		ms	D	D ₂	832	sh	m			721		m		D ₃
B	B ₁	2965	sh	w																																															
		2925		w																																															
		(2590)		w																																															
		2487		w																																															
	B ₂	1808		mw																																															
C		1410		ms																																															
		863		ms																																															
D	D ₂	832	sh	m																																															
		721		m																																															
	D ₃	304		ms																																															

MINERAL NAME RHODOCHROSITE	SUB GROUP	GROUP CALCITE	CLASS	SPECTRA NO 234¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME SMITHSONITE	SUB GROUP	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO 232																																					
CHEMICAL FORMULA (IDEAL) ZnCO₃		CHEMICAL FORMULA (ACTUAL)																																							
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R$\bar{3}$c (167)	a: 4.6533 α:	b: β:	c: 15.028 γ:																																					
		Z: 6	D: 4.30-4.45 (MEAS.)																																						
ORIGIN OF SAMPLE Kelly Mine Socorro Co., NEW MEXICO USA	REMARKS a_{rh}: 5.669, α: 48° 26', Z: 2		PARTICLE SIZE	CONC 4 mg																																					
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																						
			<table border="1"> <tr> <td>B</td> <td>B₁</td> <td>(2840)</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>2490</td> <td>w</td> <td></td> </tr> <tr> <td></td> <td>B₂</td> <td>1815</td> <td>mw</td> <td></td> </tr> <tr> <td>C</td> <td></td> <td>1417</td> <td>s</td> <td></td> </tr> <tr> <td></td> <td></td> <td>868</td> <td>s</td> <td></td> </tr> <tr> <td>D</td> <td>D₂</td> <td>838</td> <td>sh</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>741</td> <td>ms</td> <td></td> </tr> <tr> <td></td> <td>D₃</td> <td>302</td> <td>ms</td> <td></td> </tr> </table>		B	B ₁	(2840)					2490	w			B ₂	1815	mw		C		1417	s				868	s		D	D ₂	838	sh	ms			741	ms			D ₃
B	B ₁	(2840)																																							
		2490	w																																						
	B ₂	1815	mw																																						
C		1417	s																																						
		868	s																																						
D	D ₂	838	sh	ms																																					
		741	ms																																						
	D ₃	302	ms																																						

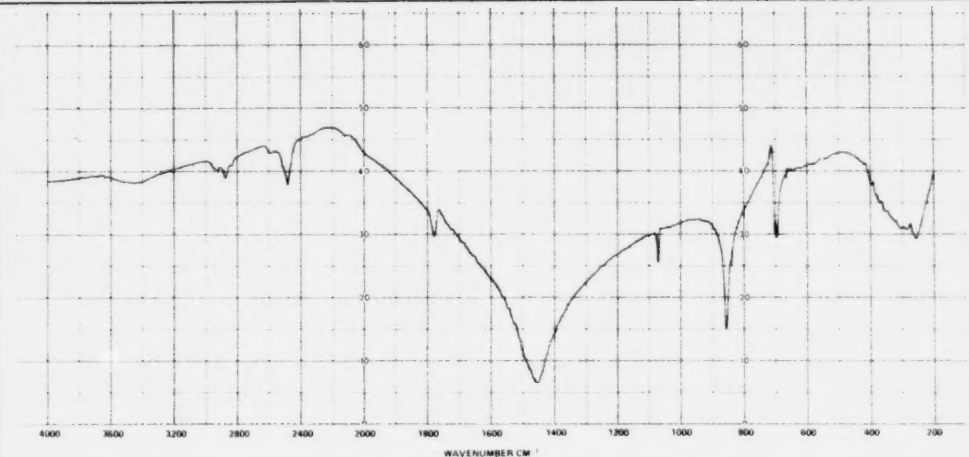
MINERAL NAME SMITHSONITE	SUB GROUP	GROUP CALCITE	CLASS CARBONATES	SPECTRA NO 232¹
CHEMICAL FORMULA (IDEAL) ZnCO₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
		Z:	D:	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

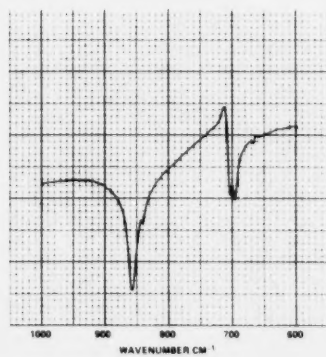
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
ARAGONITE		ARAGONITE	CARBONATES	241			
	CHEMICAL FORMULA (IDEAL) CaCO ₃		CHEMICAL FORMULA (ACTUAL)				
CRYSTAL SYSTEM	SPACE GROUP	a: 4.959 α:	b: 7.968 β:	c: 5.741 γ:			
ORTHORHOMBIC	Pmcn (62)		Z: 4	D: 2.930 (MEAS.)			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Molina De Aragon, SPAIN				CONC 4 mg			
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
					2980	w	
					2918	mw	
				B	B ₁	2850	w
					2624	w	
					2550	w	
					2523	mw	
					2498	mw	
					B ₂	1792	mw
				C		1470	s
	D ₁	1080	m				
		855	ms				
		840	sh m				
D	D ₂	709	ms				
		969	ms				
		665	sh w				

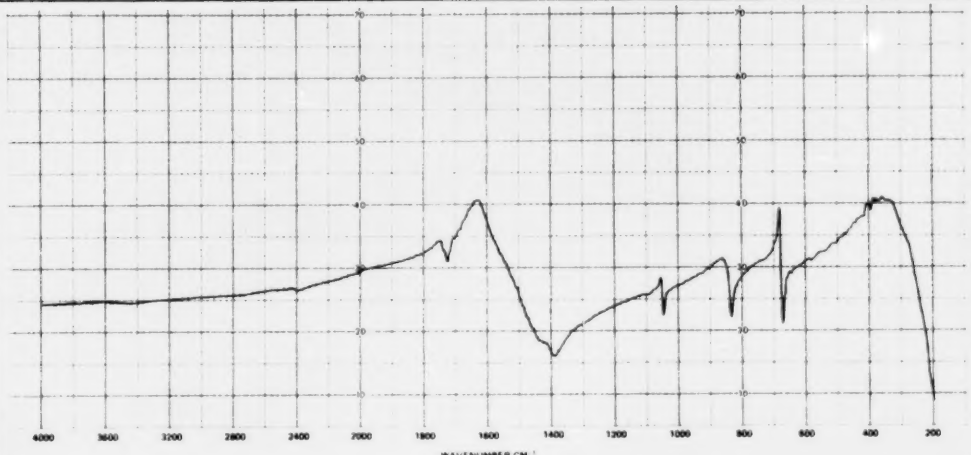
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
ARAGONITE		ARAGONITE	CARBONATES	241 ¹
	CHEMICAL FORMULA (IDEAL) CaCO ₃		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE CONC mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)

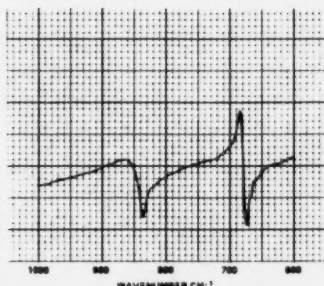
MINERAL NAME WITHERITE	SUB GROUP	GROUP ARAGONITE	CLASS CARBONATES	SPECTRA NO. A299																																					
CHEMICAL FORMULA (IDEAL) BaCO₃		CHEMICAL FORMULA (ACTUAL)																																							
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pmcn (62)	a: 5.314 α:	b: 8.904 β:	c: 6.430 γ: Z: 4 D: 4.308																																					
ORIGIN OF SAMPLE GSC 13199	REMARKS		PARTICLE SIZE	CONC 2 mg																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																						
			<table> <tr><td>B</td><td>B₁</td><td>2885</td><td>W</td></tr> <tr><td></td><td></td><td>2822</td><td>W</td></tr> <tr><td></td><td></td><td>2555</td><td>W</td></tr> <tr><td></td><td></td><td>2454</td><td>mw</td></tr> <tr><td></td><td>B₂</td><td>1760</td><td>mw</td></tr> <tr><td>C</td><td></td><td>1430</td><td>S</td></tr> <tr><td></td><td>D₁</td><td>1059</td><td>mw</td></tr> <tr><td></td><td></td><td>859</td><td>ms</td></tr> <tr><td>D</td><td>D₂</td><td>837</td><td>sh mw</td></tr> <tr><td></td><td></td><td>689</td><td>ms</td></tr> </table>		B	B ₁	2885	W			2822	W			2555	W			2454	mw		B ₂	1760	mw	C		1430	S		D ₁	1059	mw			859	ms	D	D ₂	837	sh mw	
B	B ₁	2885	W																																						
		2822	W																																						
		2555	W																																						
		2454	mw																																						
	B ₂	1760	mw																																						
C		1430	S																																						
	D ₁	1059	mw																																						
		859	ms																																						
D	D ₂	837	sh mw																																						
		689	ms																																						

MINERAL NAME WITHERITE	SUB GROUP	GROUP ARAGONITE	CLASS CARBONATES	SPECTRA NO. A299¹
CHEMICAL FORMULA (IDEAL) BaCO₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME STRONTIANITE	SUB GROUP	GROUP ARAGONITE	CLASS CARBONATES	SPECTRA NO 231																																																	
CHEMICAL FORMULA (IDEAL) SrCO₃		CHEMICAL FORMULA (ACTUAL)																																																			
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pmcn (62)	a: 5.107 α:	b: 8.414 β:	c: 6.029 γ:																																																	
		Z: 4	D: 3.785 (MEAS.)																																																		
ORIGIN OF SAMPLE Oberdorf, AUSTRIA	REMARKS		PARTICLE SIZE	CONC 4 mg																																																	
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																		
			<table border="0"> <tr><td></td><td>2930</td><td>)</td><td>w</td></tr> <tr><td></td><td>2875</td><td>)</td><td>w</td></tr> <tr><td>B</td><td>2835</td><td>)</td><td>w</td></tr> <tr><td>B₁</td><td>2590</td><td>)</td><td>w</td></tr> <tr><td></td><td>2510</td><td>)</td><td>sh w</td></tr> <tr><td></td><td>2483</td><td>)</td><td>mw</td></tr> <tr><td>B₂</td><td>1777</td><td></td><td>mw</td></tr> <tr><td>C</td><td>1451</td><td></td><td>s</td></tr> <tr><td>D₁</td><td>1070</td><td></td><td>mw</td></tr> <tr><td></td><td>856</td><td>)</td><td>s</td></tr> <tr><td>D</td><td>840</td><td>)</td><td>sh m</td></tr> <tr><td>D₂</td><td>700</td><td></td><td>ms</td></tr> <tr><td></td><td>666</td><td>)</td><td>sh w</td></tr> </table>			2930	)	w		2875	)	w	B	2835	)	w	B ₁	2590	)	w		2510	)	sh w		2483	)	mw	B ₂	1777		mw	C	1451		s	D ₁	1070		mw		856	)	s	D	840	)	sh m	D ₂	700		ms	
	2930	)	w																																																		
	2875	)	w																																																		
B	2835	)	w																																																		
B ₁	2590	)	w																																																		
	2510	)	sh w																																																		
	2483	)	mw																																																		
B ₂	1777		mw																																																		
C	1451		s																																																		
D ₁	1070		mw																																																		
	856	)	s																																																		
D	840	)	sh m																																																		
D ₂	700		ms																																																		
	666	)	sh w																																																		

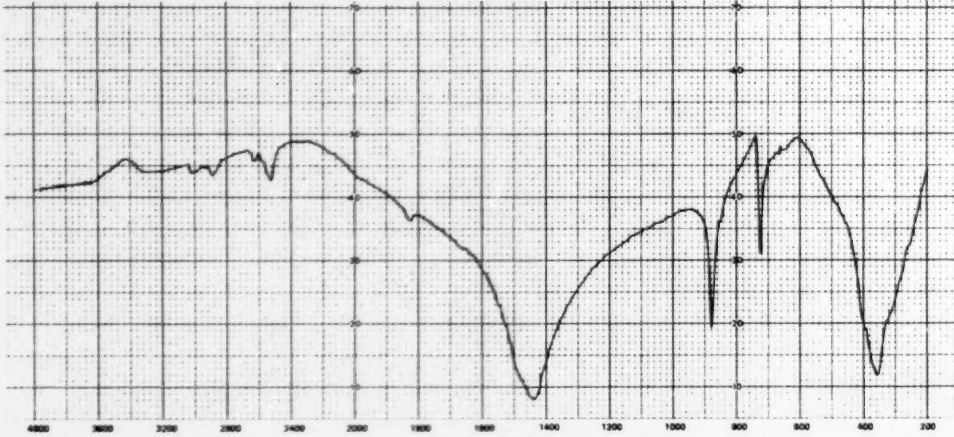
MINERAL NAME STRONTIANITE	SUB GROUP	GROUP ARAGONITE	CLASS CARBONATES	SPECTRA NO 231¹
CHEMICAL FORMULA (IDEAL) SrCO₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
		Z:	D:	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

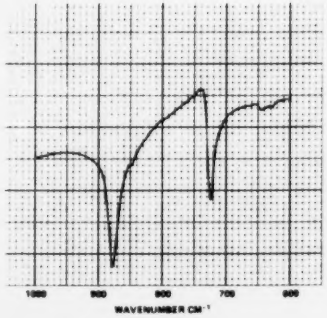
MINERAL NAME CERUSSITE	SUB GROUP	GROUP ARAGONITE	CLASS CARBONATES	SPECTRA NO 237																			
CHEMICAL FORMULA (IDEAL) PbCO₃		CHEMICAL FORMULA (ACTUAL)																					
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pmcn (62)	a: 5.195 α:	b: 8.436 β:	c: 6.152 γ: Z: 4 D: 6.582 (MEAS.)																			
ORIGIN OF SAMPLE Tsumeb, S.W. AFRICA	REMARKS		PARTICLE SIZE	CONC 6 mg																			
			MAJOR ABSORPTION BANDS (cm⁻¹)																				
			<table border="1"> <tr> <td>B</td> <td>B₂</td> <td>1738</td> <td>mw</td> </tr> <tr> <td rowspan="2">C</td> <td></td> <td>1425</td> <td>sh</td> </tr> <tr> <td></td> <td>1388</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>1050</td> <td>ms</td> </tr> <tr> <td rowspan="2">D</td> <td></td> <td>836</td> <td>ms</td> </tr> <tr> <td>D₂</td> <td>674</td> <td>ms</td> </tr> </table>		B	B ₂	1738	mw	C		1425	sh		1388	s		D ₁	1050	ms	D		836	ms
B	B ₂	1738	mw																				
C		1425	sh																				
		1388	s																				
	D ₁	1050	ms																				
D		836	ms																				
	D ₂	674	ms																				

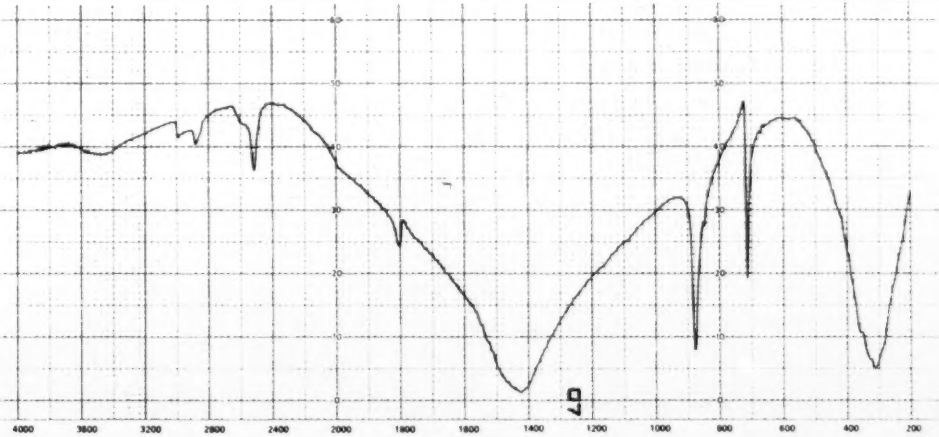
MINERAL NAME CERUSSITE	SUB GROUP	GROUP ARAGONITE	CLASS CARBONATES	SPECTRA NO 237¹
CHEMICAL FORMULA (IDEAL) PbCO₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

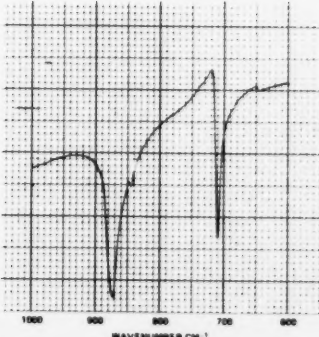
MINERAL NAME DOLOMITE	SUB GROUP	GROUP DOLOMITE	CLASS CARBONATES	SPECTRA NO. 244																												
CHEMICAL FORMULA (IDEAL) $\text{CaMg}(\text{CO}_3)_2$		CHEMICAL FORMULA (ACTUAL)																														
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $\bar{R}3 (148)$	a: 4.8112 α :	b: β :	c: 16.02 γ : Z: 3 D: 2.862 (MEAS.)																												
ORIGIN OF SAMPLE Joplin, MISSOURI, USA	REMARKS $a_{rh}: 6.01, \alpha: 47^\circ 30', Z: 1$	PARTICLE SIZE	CONC. 4 mg																													
		MAJOR ABSORPTION BANDS (cm⁻¹)																														
		<table border="0"> <tr><td></td><td>3000</td><td>w</td></tr> <tr><td>B</td><td>2895</td><td>mw</td></tr> <tr><td>B₁</td><td>2628</td><td>w</td></tr> <tr><td></td><td>2525</td><td>mw</td></tr> <tr><td>B₂</td><td>1821</td><td>w</td></tr> <tr><td>C</td><td>1430</td><td>s</td></tr> <tr><td></td><td>878</td><td>s</td></tr> <tr><td>D</td><td>849</td><td>sh</td></tr> <tr><td></td><td>726</td><td>ms</td></tr> <tr><td>D₃</td><td>348</td><td>s</td></tr> </table>				3000	w	B	2895	mw	B ₁	2628	w		2525	mw	B ₂	1821	w	C	1430	s		878	s	D	849	sh		726	ms	D ₃
	3000	w																														
B	2895	mw																														
B ₁	2628	w																														
	2525	mw																														
B ₂	1821	w																														
C	1430	s																														
	878	s																														
D	849	sh																														
	726	ms																														
D ₃	348	s																														

MINERAL NAME DOLOMITE	SUB GROUP	GROUP DOLOMITE	CLASS CARBONATES	SPECTRA NO. 244 ¹
CHEMICAL FORMULA (IDEAL) $\text{CaMg}(\text{CO}_3)_2$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC. mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		

MINERAL NAME ANKERITE	SUB GROUP	GROUP DOLOMITE	CLASS CARBONATES	SPECTRA NO A237																																					
CHEMICAL FORMULA (IDEAL) $\text{Ca}(\text{Fe}, \text{Mg})(\text{CO}_3)_2$		CHEMICAL FORMULA (ACTUAL)																																							
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $R\bar{3} (148)$	a: 4.819 α:	b: β:	c: 16.10 γ: Z: 3 D: 2.998																																					
ORIGIN OF SAMPLE California, U.S.A.	REMARKS $a_{rh}: 6.045, \alpha: 47^{\circ}00', Z: 1$		PARTICLE SIZE	CONC 1 mg																																					
			MAJOR ABSORPTION BANDS (cm^{-1})																																						
			<table border="0"> <tr> <td>A</td> <td>A_4</td> <td>3020</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>2897</td> <td>w</td> </tr> <tr> <td>B</td> <td>B_1</td> <td>2625</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>2522</td> <td>w</td> </tr> <tr> <td>B</td> <td>B_2</td> <td>1823</td> <td>mw</td> </tr> <tr> <td>C</td> <td></td> <td>1437</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>879</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D_2</td> <td>849</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>725</td> <td>ms</td> </tr> <tr> <td></td> <td>D_3</td> <td>359</td> <td>s</td> </tr> </table>		A	A_4	3020	w			2897	w	B	B_1	2625	w			2522	w	B	B_2	1823	mw	C		1437	s			879	ms	D	D_2	849	sh			725	ms	
A	A_4	3020	w																																						
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B	B_1	2625	w																																						
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B	B_2	1823	mw																																						
C		1437	s																																						
		879	ms																																						
D	D_2	849	sh																																						
		725	ms																																						
	D_3	359	s																																						

MINERAL NAME ANKERITE	SUB GROUP	GROUP DOLOMITE	CLASS CARBONATES	SPECTRA NO A237¹
CHEMICAL FORMULA (IDEAL) $\text{Ca}(\text{Fe}, \text{Mg})(\text{CO}_3)_2$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

MINERAL NAME ALSTONITE	SUB GROUP	GROUP DOLOMITE	CLASS CARBONATES	SPECTRA NO A300																														
CHEMICAL FORMULA (IDEAL) CaBa(CO₃)₂		CHEMICAL FORMULA (ACTUAL)																																
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP P2₁ (4)	a: 8.134 α:	b: 5.229 β: 106°02'	c: 6.547 γ:																														
ORIGIN OF SAMPLE GSC 15222		REMARKS	PARTICLE SIZE	CONC 2 mg																														
			MAJOR ABSORPTION BANDS (cm ⁻¹) <table> <tr><td></td><td>2985</td><td>w</td></tr> <tr><td></td><td>2878</td><td>w</td></tr> <tr><td>B</td><td>B₁ 2580</td><td>sh w</td></tr> <tr><td></td><td>2518</td><td>mw</td></tr> <tr><td></td><td>B₂ 1802</td><td>mw</td></tr> <tr><td>C</td><td>1420</td><td>s</td></tr> <tr><td></td><td>872</td><td>s</td></tr> <tr><td>D</td><td>D₂ 843</td><td>sh mw</td></tr> <tr><td></td><td>708</td><td>ms</td></tr> <tr><td></td><td>D₃ 308</td><td>s</td></tr> </table>			2985	w		2878	w	B	B ₁ 2580	sh w		2518	mw		B ₂ 1802	mw	C	1420	s		872	s	D	D ₂ 843	sh mw		708	ms		D ₃ 308	s
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D	D ₂ 843	sh mw																																
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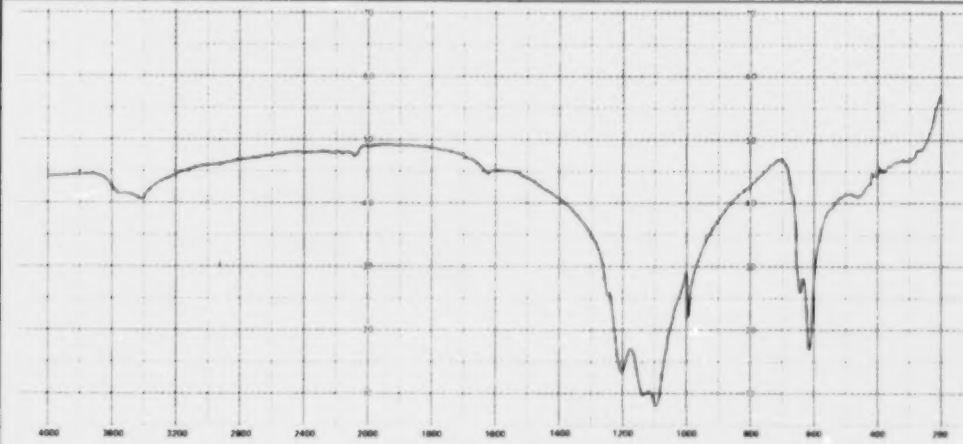
MINERAL NAME ALSTONITE	SUB GROUP	GROUP DOLOMITE	CLASS CARBONATES	SPECTRA NO A300¹
CHEMICAL FORMULA (IDEAL) CaMg₃(CO₃)₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

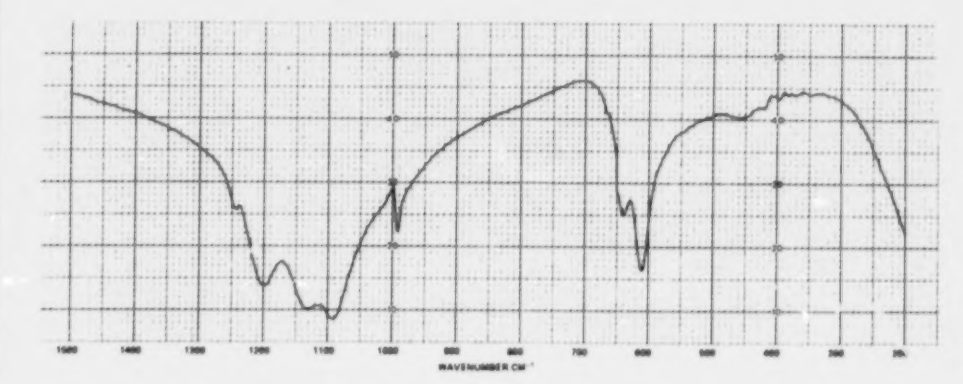
MINERAL NAME AZURITE	SUB-GROUP	GROUP	CLASS HYDROXY-CARBONATES	SPECTRA NO 275																																																																					
CHEMICAL FORMULA (IDEAL) $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$		CHEMICAL FORMULA (ACTUAL)																																																																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $P2_1/c$ (14)	a: 5.008 α:	b: 5.844 β: 92.45°	c: 10.336 γ:																																																																					
ORIGIN OF SAMPLE Arizona, USA		REMARKS	PARTICLE SIZE	CONC 3 mg																																																																					
			MAJOR ABSORPTION BANDS (cm^{-1})																																																																						
			<table border="0"> <tr><td>A</td><td>A₂</td><td>3427</td><td>ms</td></tr> <tr><td></td><td>B₁</td><td>2495</td><td>w</td></tr> <tr><td>B</td><td>B₂</td><td>1882</td><td></td></tr> <tr><td></td><td></td><td>1863</td><td>w</td></tr> <tr><td></td><td></td><td>1833</td><td></td></tr> <tr><td>C</td><td></td><td>1462</td><td>sh</td></tr> <tr><td></td><td></td><td>1413</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>1088</td><td>w</td></tr> <tr><td></td><td></td><td>948</td><td>ms</td></tr> <tr><td></td><td></td><td>833</td><td>ms</td></tr> <tr><td></td><td></td><td>811</td><td></td></tr> <tr><td>D</td><td>D₂</td><td>763</td><td>w</td></tr> <tr><td></td><td></td><td>735</td><td>w</td></tr> <tr><td></td><td></td><td>488</td><td>w</td></tr> <tr><td></td><td></td><td>446</td><td>ms</td></tr> <tr><td></td><td></td><td>398</td><td>ms</td></tr> <tr><td>D₃</td><td></td><td>338</td><td>w</td></tr> <tr><td></td><td></td><td>300</td><td>ms</td></tr> </table>		A	A ₂	3427	ms		B ₁	2495	w	B	B ₂	1882				1863	w			1833		C		1462	sh			1413	s		D ₁	1088	w			948	ms			833	ms			811		D	D ₂	763	w			735	w			488	w			446	ms			398	ms	D ₃		338	w	
A	A ₂	3427	ms																																																																						
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B	B ₂	1882																																																																							
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C		1462	sh																																																																						
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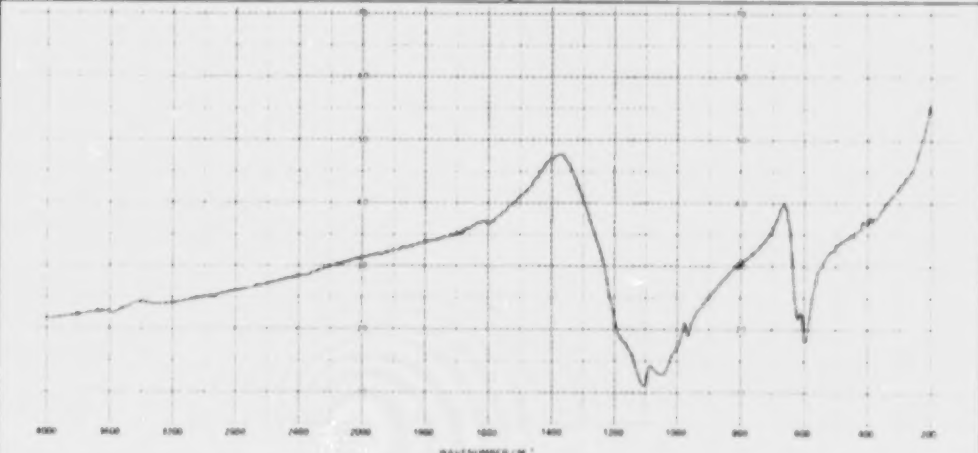
MINERAL NAME BASTNASITE	SUB-GROUP	GROUP	CLASS CARBONATES	SPECTRA NO 229
CHEMICAL FORMULA (IDEAL) (Ce, La)CO₃F		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP $P6_2c$ (190)	a: 7.129 α:	b: β:	c: 9.774 γ:
ORIGIN OF SAMPLE Ambositra, MADAGASCAR		REMARKS	PARTICLE SIZE	CONC 5 mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

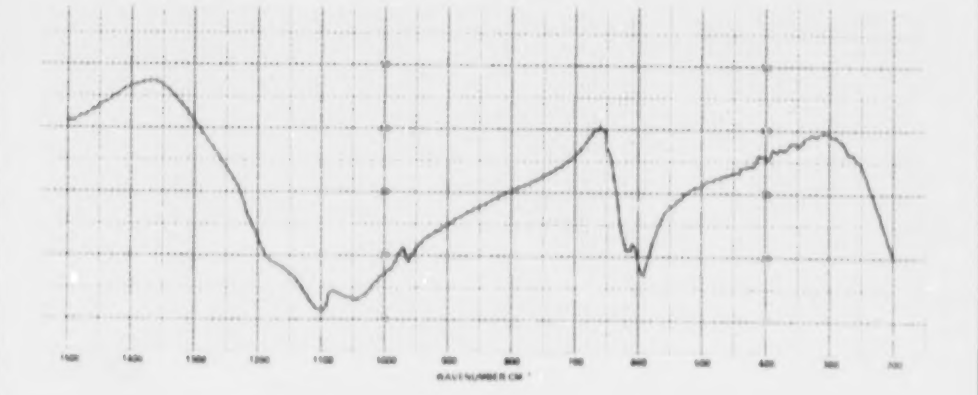
MINERAL NAME BARITE	SUB GROUP	GROUP BARITE	CLASS SULFATES	SPECTRA NO 199
CHEMICAL FORMULA (IDEAL) BaSO₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnma (62)	a: 8.878 α:	b: 5,450 β:	c: 7.152 γ:
ORIGIN OF SAMPLE Superior, Arizona, USA		REMARKS	PARTICLE SIZE	CONC 5 mg
			MAJOR ABSORPTION BANDS (cm ⁻¹) 1170 1110 D ₁ 1078 s D 979 mw 639sh D ₂ 605 s	

MINERAL NAME BARITE	SUB GROUP	GROUP	CLASS	SPECTRA NO 199
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME CELESTITE	SUB GROUP	GROUP BARITE	CLASS SULFATES	SPECTRA NO 189
CELESTINE	CHEMICAL FORMULA (IDEAL) SrSO₄		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnma (62)	a: 8.359 α:	b: 5.352 β:	c: 6.866 γ:
		Z: 4	D: 3.971	
ORIGIN OF SAMPLE Yagamata, JAPAN	REMARKS			PARTICLE SIZE 0.7_{mg}
				MAJOR ABSORPTION BANDS (cm ⁻¹) 1242 sh 1195 D ₁ 1130 1090 990 m D ₂ 639 sh 609 D ₃ 455 s w

MINERAL NAME CELESTITE	SUB GROUP	GROUP BARITE	CLASS	SPECTRA NO 189
	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
		Z:	D:	
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)

MINERAL NAME ANGLESITE	SUB GROUP	GROUP BARITE	CLASS SULFATES	SPECTRA NO 192															
CHEMICAL FORMULA (IDEAL) PbSO₄		CHEMICAL FORMULA (ACTUAL)																	
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnma (62)	a: 8.480 α:	b: 5.398 β:	c: 6.958 γ:															
		Z: 4	D: 6.38																
ORIGIN OF SAMPLE Bunker Hill, Idaho, USA	REMARKS		PARTICLE SIZE	CONC 2.5mg															
			MAJOR ABSORPTION BANDS (cm⁻¹)																
			<table> <tr> <td>D₁</td> <td>1160, sh</td> <td></td> </tr> <tr> <td></td> <td>1105</td> <td>s</td> </tr> <tr> <td></td> <td>1048</td> <td></td> </tr> <tr> <td>D</td> <td>962</td> <td>w</td> </tr> <tr> <td>D₂</td> <td>623, sh</td> <td></td> </tr> <tr> <td></td> <td>592</td> <td>s</td> </tr> </table>		D ₁	1160, sh			1105	s		1048		D	962	w	D ₂	623, sh	
D ₁	1160, sh																		
	1105	s																	
	1048																		
D	962	w																	
D ₂	623, sh																		
	592	s																	

MINERAL NAME ANGLESITE	SUB GROUP	GROUP BARITE	CLASS	SPECTRA NO 192
CHEMICAL FORMULA (IDEAL) PbSO₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
		Z:	D:	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME ANHYDRITE	SUB-GROUP	GROUP BARITE	CLASS SULFATES	SPECTRA NO A242
CHEMICAL FORMULA (IDEAL) CaSO_4		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Bmmm (63)	a: 6.238 α:	b: 6.991 β:	c: 6.996 γ: Z: 4 D: 2.963
ORIGIN OF SAMPLE GSC (61)	REMARKS	PARTICLE SIZE	CONC 1 mg	
				MAJOR ABSORPTION BANDS (cm^{-1}) D ₁ 1151) 1115) s D ₂ 670) ms 606) sh D ₃ 595) ms

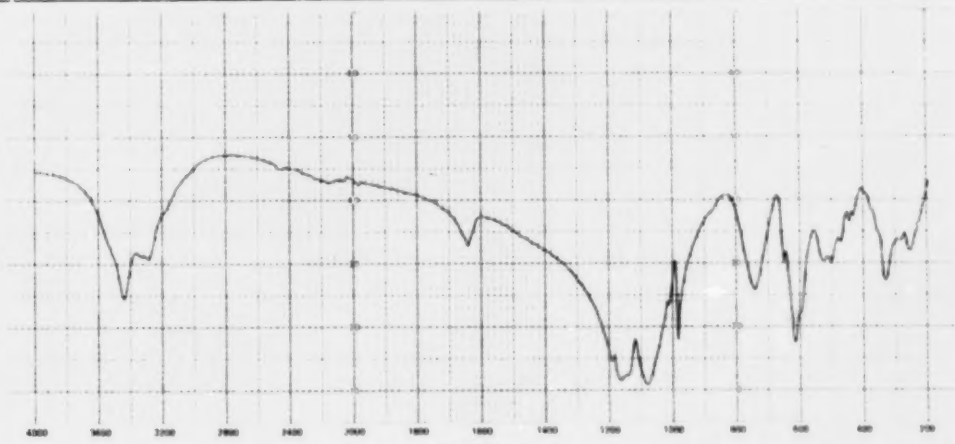
MINERAL NAME ANHYDRITE	SUB-GROUP	GROUP BARITE	CLASS SULFATES	SPECTRA NO A242'
CHEMICAL FORMULA (IDEAL) CaSO_4		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
				MAJOR ABSORPTION BANDS (cm^{-1})

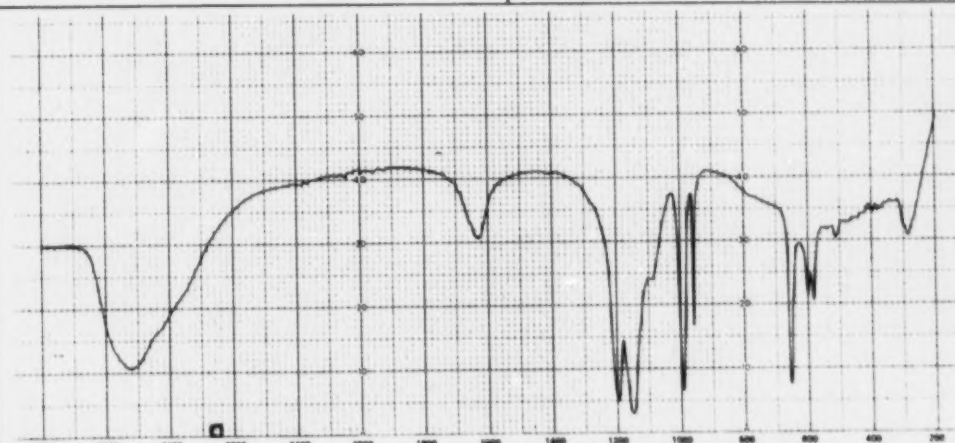
MINERAL NAME MIRABILITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 203																
CHEMICAL FORMULA (IDEAL) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$			CHEMICAL FORMULA (ACTUAL)																	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $P2_1/a$ (14)	a: 12.84 α:	b: 10.37 β: 107.77°	c: 11.52 γ:																
			Z: 4	D: 1.465																
ORIGIN OF SAMPLE Ormiston, SASKATCHEWAN, CANADA		REMARKS		PARTICLE SIZE 2 mg																
				MAJOR ABSORPTION BANDS (cm^{-1}) <table border="1"> <tr> <td>A</td> <td>A_3</td> <td>3440</td> <td>W</td> </tr> <tr> <td></td> <td>D_1</td> <td>1120</td> <td>S</td> </tr> <tr> <td>D</td> <td>D_2</td> <td>613</td> <td>S</td> </tr> <tr> <td></td> <td>D_3</td> <td>302</td> <td>m</td> </tr> </table>	A	A_3	3440	W		D_1	1120	S	D	D_2	613	S		D_3	302	m
A	A_3	3440	W																	
	D_1	1120	S																	
D	D_2	613	S																	
	D_3	302	m																	

MINERAL NAME MIRABILITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 203
CHEMICAL FORMULA (IDEAL) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$			CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
			Z:	D:
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE mg
				MAJOR ABSORPTION BANDS (cm^{-1})

MINERAL NAME KROHNKITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 196																										
CHEMICAL FORMULA (IDEAL) $\text{Na}_2\text{Cu}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																												
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $P2_1/c$ (14)	a: 5.794 α :	b: 12.640 β : $108^\circ 35'$	c: 5.514 γ : Z: 2 D: 2.95																										
ORIGIN OF SAMPLE Chuquicamata, CHILI	REMARKS	PARTICLE SIZE	CONC 4 mg																											
		MAJOR ABSORPTION BANDS (cm^{-1})																												
		<table border="0"> <tr> <td>A₄</td> <td>3080</td> <td>s</td> </tr> <tr> <td>B₂</td> <td>1700</td> <td rowspan="2">mw</td> </tr> <tr> <td></td> <td>1630</td> </tr> <tr> <td rowspan="4">D₁</td> <td>1180</td> <td rowspan="4">s</td> </tr> <tr> <td>1146</td> </tr> <tr> <td>1105</td> </tr> <tr> <td>1050</td> </tr> <tr> <td rowspan="2">D₂</td> <td>988</td> <td>ms</td> </tr> <tr> <td>763</td> <td>m</td> </tr> <tr> <td rowspan="4">D₃</td> <td>640</td> <td rowspan="2">mw</td> </tr> <tr> <td>595</td> </tr> <tr> <td>570</td> <td>sh ms</td> </tr> <tr> <td>468</td> <td rowspan="2">sh mw</td> </tr> <tr> <td>443</td> </tr> </table>			A ₄	3080	s	B ₂	1700	mw		1630	D ₁	1180	s	1146	1105	1050	D ₂	988	ms	763	m	D ₃	640	mw	595	570	sh ms	468
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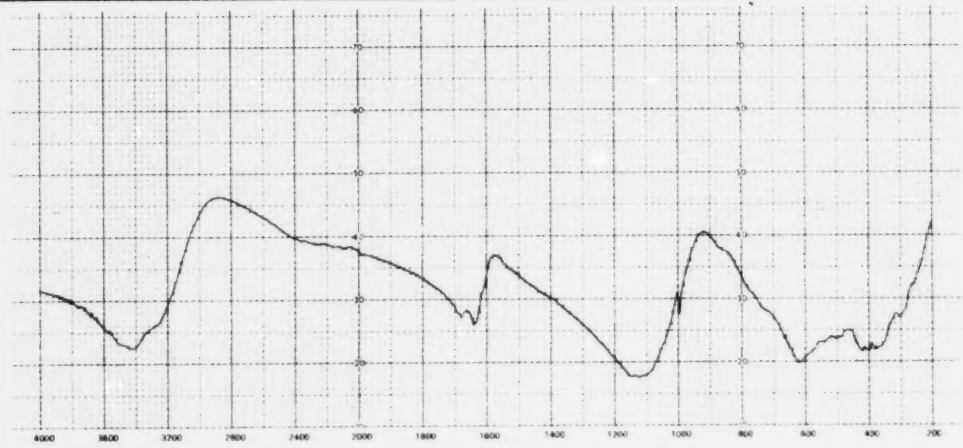
MINERAL NAME KROHNKITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 196
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm^{-1})		

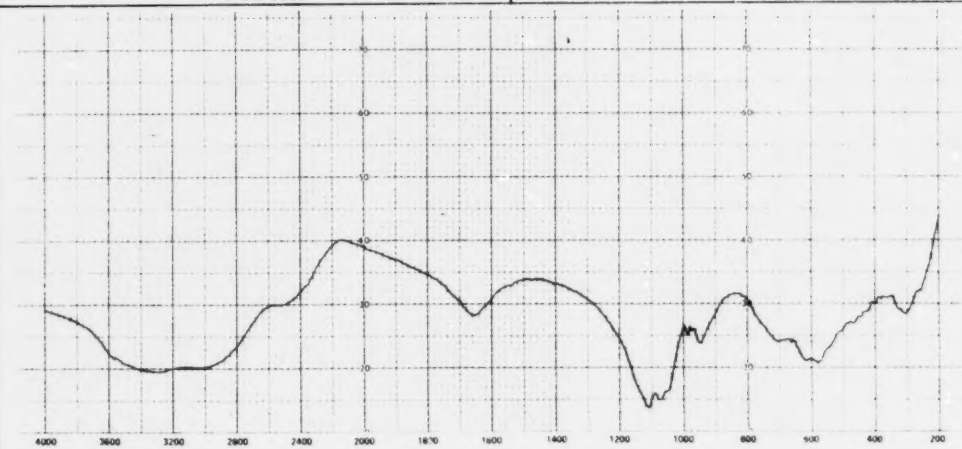
MINERAL NAME POLYHALITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO A279																																																												
CHEMICAL FORMULA (IDEAL) $K_2Ca_2Mg(SO_4)_2 \cdot 2H_2O$			CHEMICAL FORMULA (ACTUAL)																																																													
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP $P\bar{1} \quad (\quad 2 \quad)$	a: 6.952 b: 8.886 c: 6.954 $\alpha: 104.06^\circ \quad \beta: 113.94^\circ \quad \gamma: 101.15^\circ \quad Z: 1 \quad D: 2.78$																																																														
ORIGIN OF SAMPLE GSC 17472	REMARKS			PARTICLE SIZE 2 mg																																																												
																																																																
MAJOR ABSORPTION BANDS																																																																
<table><tr><td></td><td>A_2</td><td>3445</td><td>ms</td></tr><tr><td>A</td><td>A_3</td><td>3290</td><td>mw</td></tr><tr><td>B</td><td>B_2</td><td>1640</td><td>mw</td></tr><tr><td></td><td></td><td>1191</td><td></td></tr><tr><td></td><td></td><td>1165</td><td>s</td></tr><tr><td></td><td></td><td>1140</td><td></td></tr><tr><td>D_1</td><td></td><td>1080</td><td>s</td></tr><tr><td></td><td></td><td>1014</td><td>sh</td></tr><tr><td></td><td></td><td>987</td><td>ms</td></tr><tr><td>D</td><td>D_2</td><td>745</td><td>ms</td></tr><tr><td></td><td></td><td>651</td><td>sh</td></tr><tr><td></td><td></td><td>619</td><td>s</td></tr><tr><td></td><td></td><td>528</td><td></td></tr><tr><td>D_3</td><td></td><td>502</td><td>mw</td></tr><tr><td></td><td></td><td>322</td><td>m</td></tr></table>						A_2	3445	ms	A	A_3	3290	mw	B	B_2	1640	mw			1191				1165	s			1140		D_1		1080	s			1014	sh			987	ms	D	D_2	745	ms			651	sh			619	s			528		D_3		502	mw			322	m
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D	D_2	745	ms																																																													
		651	sh																																																													
		619	s																																																													
		528																																																														
D_3		502	mw																																																													
		322	m																																																													

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
CHALCANTHITE			SULFATES	A301		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
CuSO ₄ · 5H ₂ O						
CRYSTAL SYSTEM	SPACE GROUP					
TRICLINIC	P $\bar{1}$ (2) a: 6.12 b: 10.69 c: 5.96 α: 97°35' β: 107°10' γ: 77°33' Z: 2 D: 2.288					
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
GSC 17277				2 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₂	3400	ms
			B	B ₂	1627	m
					1198	s
					1152	s
			D ₁		1090	sh
					996	s
					960	s
			D ₂		667	s
					600	s
			D ₃		584	ms

MINERAL NAME GYPSUM	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO. 197																																									
CHEMICAL FORMULA (IDEAL) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/c ()	a: 6.286 α :	b: 15.213 β : 114.08°	c: 5.678 γ : Z: 4 D: 2.305																																									
ORIGIN OF SAMPLE Russell Co., Kansas, USA	REMARKS		PARTICLE SIZE	CONC 0.7 mg																																									
			MAJOR ABSORPTION BANDS (cm^{-1})																																										
			<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3560</td> <td>S</td> </tr> <tr> <td></td> <td>A₂</td> <td>3410</td> <td></td> </tr> <tr> <td></td> <td>A₃</td> <td>3247 sh</td> <td>w</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1687</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>1621</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>1160</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1002 sh</td> <td></td> </tr> <tr> <td>D</td> <td>D₂</td> <td>667</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>600</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>455</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>302</td> <td>m</td> </tr> </table>		A	A ₂	3560	S		A ₂	3410			A ₃	3247 sh	w	B	B ₂	1687	ms			1621	s		D ₁	1160	s			1002 sh		D	D ₂	667	s			600	s		D ₃	455	mw	
A	A ₂	3560	S																																										
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		600	s																																										
	D ₃	455	mw																																										
		302	m																																										

MINERAL NAME GYPSUM	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO. 197
CHEMICAL FORMULA (IDEAL) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO				
EPSOMITE			SULPHATES	A305				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)						
MgSO ₄ · 7H ₂ O								
CRYSTAL SYSTEM	SPACE GROUP	a: 11.86 α:	b: 11.99 β:	c: 6.858 γ:	Z: 4	D: 1.678		
ORTHORHOMBIC	P2 ₁ 2 ₁ 2 ₁ (19)							
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC		
GSC 62295						1 mg		
					MAJOR ABSORPTION BANDS (cm ⁻¹)			
					A	A ₂	3430	ms
					B	B ₂	1676	m
							1638	m
							1147	)
					D ₁		1123	
							1102	
							997	m
					D ₂		619	ms
							418	
							405	ms
					D ₃		382	
		301	w					

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
HALOTRICHITE			SULFATES	A254			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
Fe ⁺ Al ₂ (SO ₄) ₄ · 22H ₂ O							
CRYSTAL SYSTEM	SPACE GROUP	a: 20.51	b: 24.29	c: 6.179	Z: 4	D: 1.95	
MONOCLINIC	P2 (3)	α:	β:	γ:			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE	CONC.		
White Mountain, Mono Co. California U.S.A.					0.7mg		
					MAJOR ABSORPTION BANDS (cm ⁻¹)		
					A	A ₃ 3310	) — ms
					A	A ₄ 3030	
					B	B ₂ 1653	mw
					D ₁	1110	) s
						1072	
						1050 /sh	
					D	990	w
						948	mw
					D ₂	700	w
						615	) — ms
					580		
					D ₃	305	mw

MINERAL NAME COQUIMBITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 193																																																						
CHEMICAL FORMULA (IDEAL) $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																																								
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $P\bar{3}c1$ (165)	a: 10.92 α :	b: β :	c: 17.14 γ : Z: 4 D: 2.109																																																						
ORIGIN OF SAMPLE Emery Co. Utah, U.S.A.	REMARKS	PARTICLE SIZE	CONC 2 mg																																																							
		MAJOR ABSORPTION BANDS (cm^{-1})																																																								
		<table border="0"> <tr> <td>A</td> <td>A₄</td> <td>3180</td> <td>s</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1658</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>1165</td> <td></td> </tr> <tr> <td></td> <td></td> <td>1107</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1066</td> <td></td> </tr> <tr> <td>D₁</td> <td></td> <td>1022</td> <td>? mw</td> </tr> <tr> <td></td> <td></td> <td>1010</td> <td></td> </tr> <tr> <td></td> <td></td> <td>942</td> <td>mw</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>825</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>695</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>595</td> <td>m</td> </tr> <tr> <td>D₃</td> <td></td> <td>481</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>328</td> <td></td> </tr> <tr> <td></td> <td></td> <td>300</td> <td>m</td> </tr> </table>			A	A ₄	3180	s	B	B ₂	1658	m			1165				1107	s			1066		D ₁		1022	? mw			1010				942	mw	D	D ₂	825	mw			695	w			595	m	D ₃		481	mw			328			
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B	B ₂	1658	m																																																							
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		1107	s																																																							
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D ₁		1022	? mw																																																							
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		942	mw																																																							
D	D ₂	825	mw																																																							
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D ₃		481	mw																																																							
		328																																																								
		300	m																																																							

MINERAL NAME COQUIMBITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 193
CHEMICAL FORMULA (IDEAL) $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm^{-1})		

MINERAL NAME ALUNOGEN	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO A298																													
CHEMICAL FORMULA (IDEAL) $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																															
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP $P\bar{1} (2)$	$a: 7.420$ $\alpha: 90.0^\circ$	$b: 26.90$ $\beta: 97.5^\circ$	$c: 6.105$ $\gamma: 91.8^\circ$ Z: 2 D: 1.782																													
ORIGIN OF SAMPLE GSC 62313	REMARKS		PARTICLE SIZE	CONC 2 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3420</td> <td>ms</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1600)</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>1630)</td> <td></td> </tr> <tr> <td></td> <td></td> <td>1095</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>992</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>950</td> <td>w</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>700) sh</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>613)</td> <td></td> </tr> </table>		A	A ₂	3420	ms	B	B ₂	1600)	ms			1630)				1095	s		D ₁	992	w			950	w	D	D ₂	700) sh	ms	
A	A ₂	3420	ms																														
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		950	w																														
D	D ₂	700) sh	ms																														
		613)																															

MINERAL NAME BROCHANTITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO A276																																																									
CHEMICAL FORMULA (IDEAL) $\text{Cu}_4(\text{SO}_4)(\text{OH})_6$		CHEMICAL FORMULA (ACTUAL)																																																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $P2/a (14)$	$a: 12.756$ $\alpha:$	$b: 9.863$ $\beta: 90.00^\circ$	$c: 6.030$ $\gamma:$ Z: 4 D: 3.97																																																									
ORIGIN OF SAMPLE GSC 13832	REMARKS		PARTICLE SIZE	CONC 1 mg																																																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																										
			<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3593)</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>3571)</td> <td></td> </tr> <tr> <td></td> <td></td> <td>3387)</td> <td></td> </tr> <tr> <td></td> <td>A₂</td> <td>3266)</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>1120)</td> <td></td> </tr> <tr> <td></td> <td>D₁</td> <td>1092)</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>990</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>940</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>870)</td> <td></td> </tr> <tr> <td></td> <td></td> <td>850)</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>780</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>735</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>600</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>505)</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>485)</td> <td>ms</td> </tr> </table>		A	A ₂	3593)	m			3571)				3387)			A ₂	3266)	ms			1120)			D ₁	1092)	s			990	mw			940	mw			870)				850)	s	D	D ₂	780	w			735	mw			600	s			505)	ms	
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	D ₃	485)	ms																																																										

MINERAL NAME LINARITE	SUB-GROUP	GROUP	CLASS SULFATES	SPECTRA NO 200																																					
CHEMICAL FORMULA (IDEAL) PbCu(SO₄)(OH)₂		CHEMICAL FORMULA (ACTUAL)																																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP P2₁/m (11)	a: 9.70 α:	b: 5.65 β: 102°48'	c: 4.68 γ:																																					
ORIGIN OF SAMPLE Old Soldier, Nevada, U.S.A.		REMARKS	PARTICLE SIZE	CONC 3 mg																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																						
			<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3450</td> <td>w</td> </tr> <tr> <td></td> <td>D₁</td> <td>1158</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>1032</td> <td></td> </tr> <tr> <td></td> <td>D₂</td> <td>792</td> <td>mw</td> </tr> <tr> <td>D</td> <td></td> <td>598</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>532</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>486</td> <td>m</td> </tr> <tr> <td></td> <td>D₃</td> <td>446</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>418</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>370</td> <td>w</td> </tr> </table>		A	A ₂	3450	w		D ₁	1158	ms			1032			D ₂	792	mw	D		598	m			532	w			486	m		D ₃	446	w			418	mw	
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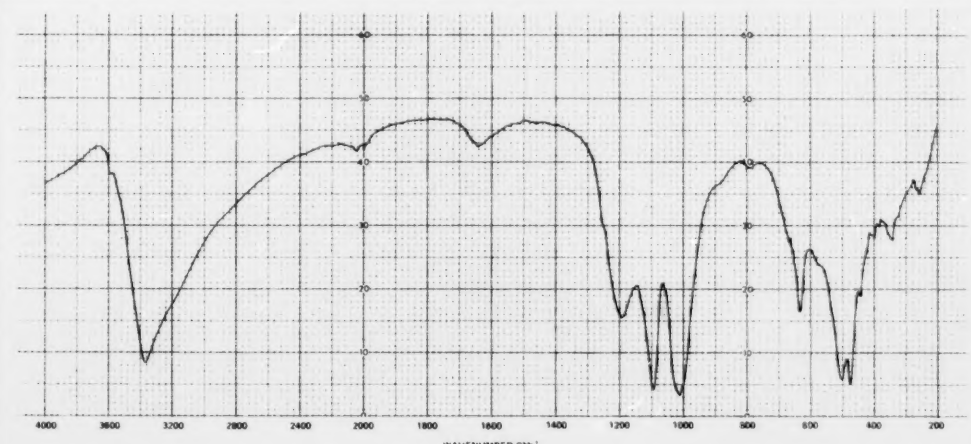
MINERAL NAME LINARITE	SUB-GROUP	GROUP	CLASS SULFATES	SPECTRA NO 200
CHEMICAL FORMULA (IDEAL) PbCu(SO₄)(OH)₂		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a:	b:	c:
		α:	β:	γ:
			Z:	D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
			MAJOR ABSORPTION BANDS (cm⁻¹)	

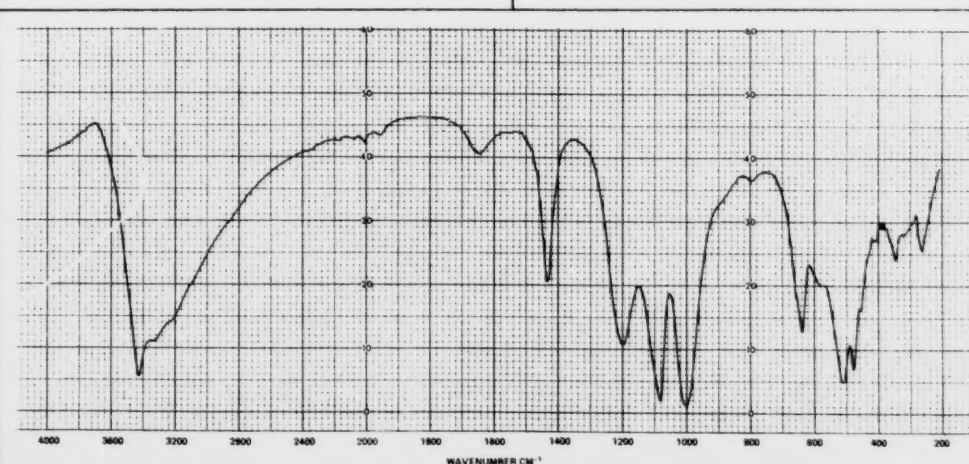
MINERAL NAME ANTLERITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO A280																																	
CHEMICAL FORMULA (IDEAL) $\text{Cu}_3(\text{SO}_4)(\text{OH})_4$		CHEMICAL FORMULA (ACTUAL)																																			
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnam (62)	a: 8.25 α:	b: 12.01 β:	c: 6.04 γ:																																	
		Z: 4	D: 3.936																																		
ORIGIN OF SAMPLE GSC 13819	REMARKS		PARTICLE SIZE	CONC 2 mg																																	
			MAJOR ABSORPTION BANDS																																		
			<table border="1"> <thead> <tr> <th>Wavenumber (cm⁻¹)</th> <th>Intensity</th> </tr> </thead> <tbody> <tr><td>3581</td><td>ms</td></tr> <tr><td>3497</td><td>ms</td></tr> <tr><td>1154</td><td>s</td></tr> <tr><td>1110</td><td>s</td></tr> <tr><td>1071</td><td>s</td></tr> <tr><td>987</td><td>m</td></tr> <tr><td>874</td><td>ms</td></tr> <tr><td>851</td><td>ms</td></tr> <tr><td>783</td><td>ms</td></tr> <tr><td>752</td><td>ms</td></tr> <tr><td>632</td><td>ms</td></tr> <tr><td>611</td><td>ms</td></tr> <tr><td>510</td><td>ms</td></tr> <tr><td>491</td><td>ms</td></tr> <tr><td>411</td><td>m</td></tr> <tr><td>362</td><td>m</td></tr> <tr><td>327</td><td>m</td></tr> </tbody> </table>		Wavenumber (cm⁻¹)	Intensity	3581	ms	3497	ms	1154	s	1110	s	1071	s	987	m	874	ms	851	ms	783	ms	752	ms	632	ms	611	ms	510	ms	491	ms	411	m	362
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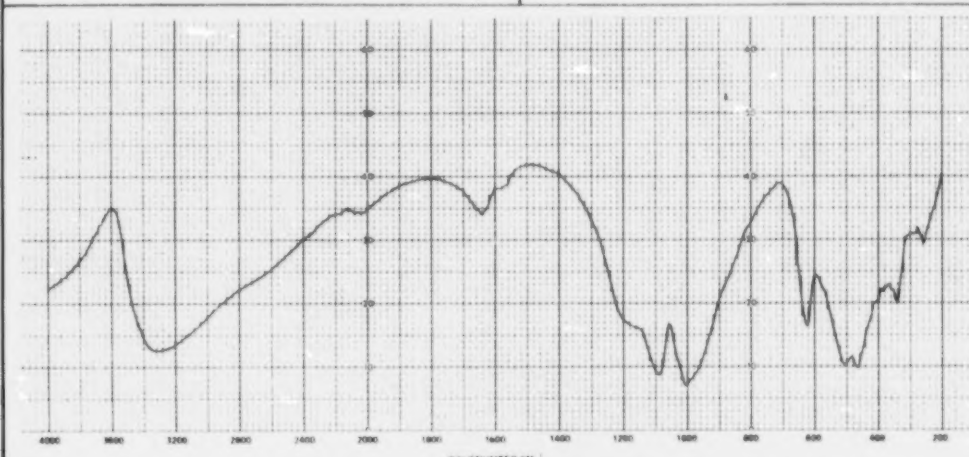
MINERAL NAME ALUNITE (K)	SUB GROUP	GROUP ALUNITE	CLASS SULFATES	SPECTRA NO 161																											
CHEMICAL FORMULA (IDEAL) $\text{KAl}_3(\text{SO}_4)_2(\text{OH})_6$		CHEMICAL FORMULA (ACTUAL)																													
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R3m (160)	a: 6.96 α:	b: β:	c: 17.35 γ:																											
		Z: 3	D: 2.82																												
ORIGIN OF SAMPLE SYNTHETIC	REMARKS		PARTICLE SIZE	CONC 2 mg																											
			MAJOR ABSORPTION BANDS																												
			<table border="1"> <thead> <tr> <th>Wavenumber (cm⁻¹)</th> <th>Intensity</th> </tr> </thead> <tbody> <tr><td>3495</td><td>s</td></tr> <tr><td>1648</td><td>mw</td></tr> <tr><td>1227</td><td>s</td></tr> <tr><td>1153</td><td>s</td></tr> <tr><td>1083</td><td>s</td></tr> <tr><td>1059</td><td>s</td></tr> <tr><td>1027</td><td>s</td></tr> <tr><td>668</td><td>s</td></tr> <tr><td>620</td><td>s</td></tr> <tr><td>590</td><td>mw</td></tr> <tr><td>500</td><td>m</td></tr> <tr><td>420</td><td>m</td></tr> <tr><td>352</td><td>sh</td></tr> <tr><td>330</td><td>ms</td></tr> </tbody> </table>		Wavenumber (cm⁻¹)	Intensity	3495	s	1648	mw	1227	s	1153	s	1083	s	1059	s	1027	s	668	s	620	s	590	mw	500	m	420	m	352
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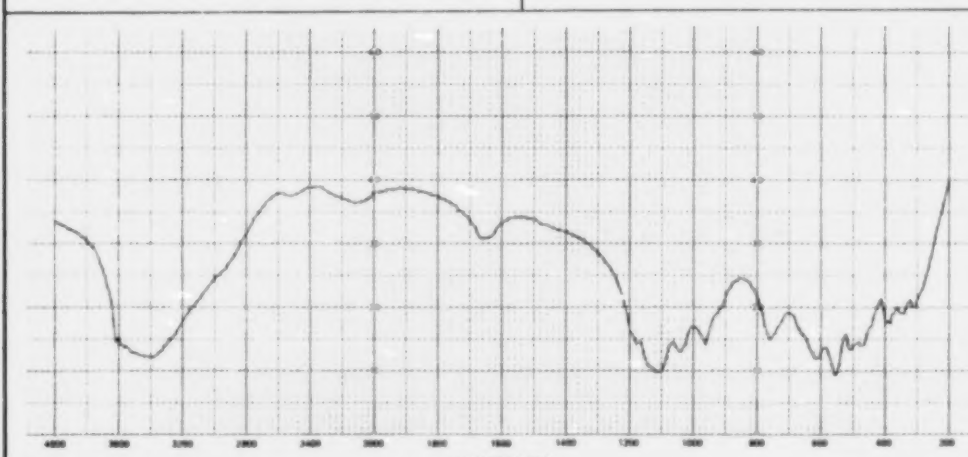
MINERAL NAME NATROALUNITE	SUB GROUP	GROUP ALUNITE	CLASS SULFATES	SPECTRA NO 163																																													
Na-ALUNITE	CHEMICAL FORMULA (IDEAL) $\text{NaAl}_3(\text{SO}_4)_2(\text{OH})_6$		CHEMICAL FORMULA (ACTUAL)																																														
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R3m (160)	a: 6.977 α:	b: β:	c: 16.74 γ: Z: 3 D: ≈2.8																																													
ORIGIN OF SAMPLE SYNTHETIC	REMARKS		PARTICLE SIZE	CONC 2 .mg																																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																																														
			<table> <tr><td>A</td><td>A₂</td><td>3460</td><td></td></tr> <tr><td></td><td>A₃</td><td>3200 sh</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1660</td><td>w</td></tr> <tr><td></td><td></td><td>1225 sh</td><td></td></tr> <tr><td></td><td>D₁</td><td>1100</td><td>s</td></tr> <tr><td></td><td></td><td>1027 sh</td><td></td></tr> <tr><td></td><td></td><td>670</td><td></td></tr> <tr><td></td><td>D₂</td><td>622</td><td>s</td></tr> <tr><td></td><td></td><td>595</td><td></td></tr> <tr><td></td><td></td><td>507</td><td>w</td></tr> <tr><td></td><td>D₃</td><td>425</td><td>m</td></tr> <tr><td></td><td></td><td>340</td><td>ms</td></tr> </table>		A	A ₂	3460			A ₃	3200 sh	s	B	B ₂	1660	w			1225 sh			D ₁	1100	s			1027 sh				670			D ₂	622	s			595				507	w		D ₃	425	m	
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		507	w																																														
	D ₃	425	m																																														
		340	ms																																														

MINERAL NAME JAROSITE	SUB GROUP	GROUP ALUNITE	CLASS SULFATES	SPECTRA NO A210																													
	CHEMICAL FORMULA (IDEAL) $\text{KFe}_3(\text{SO}_4)_2(\text{OH})_6$		CHEMICAL FORMULA (ACTUAL)																														
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R3m (160)	a: 7.20 α:	b: β:	c: 17.00 γ: Z: 3 D: 3.25																													
ORIGIN OF SAMPLE SYNTHETIC	REMARKS		PARTICLE SIZE	CONC 1 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table> <tr><td>A</td><td>A₃</td><td>3390</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>mw</td></tr> <tr><td></td><td></td><td>1200</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>1085</td><td>s</td></tr> <tr><td></td><td></td><td>1005</td><td>s</td></tr> <tr><td>D</td><td>D₂</td><td>630</td><td>m</td></tr> <tr><td></td><td></td><td>502</td><td></td></tr> <tr><td></td><td>D₃</td><td>475</td><td>s</td></tr> </table>		A	A ₃	3390	s	B	B ₂	1640	mw			1200	ms		D ₁	1085	s			1005	s	D	D ₂	630	m			502		
A	A ₃	3390	s																														
B	B ₂	1640	mw																														
		1200	ms																														
	D ₁	1085	s																														
		1005	s																														
D	D ₂	630	m																														
		502																															
	D ₃	475	s																														

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
NATROJAROSITE		ALUNITE	SULFATES	A208
CHEMICAL FORMULA (IDEAL) NaFe ₃ (SO ₄) ₂ (OH) ₆		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R3m (160)	a: 7.34 α:	b: β:	c: 16.72 γ: Z: 3 D: 2.878
ORIGIN OF SAMPLE SYNTHETIC	REMARKS			PARTICLE SIZE CONC 1 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				A A ₂ 3370 S
				B B ₂ 1640 mw
				1190 ms
				D ₁ 1091 S
				1016 S
				D D ₂ 630 ms
				500 S
				D ₃ 475 S
				345 w

MINERAL NAME AMMONIOJAROSITE	SUB-GROUP	GROUP ALUNITE	CLASS SULFATES	SPECTRA NO A209																																	
NH ⁴ -JAROSITE	CHEMICAL FORMULA (IDEAL) (NH ₄)Fe ₃ (SO ₄) ₂ (OH) ₆		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R3m (?)	a: 7.3 α:	b: β: c: 17.1 γ:	Z: 3 D: 3.028																																	
ORIGIN OF SAMPLE SYNTHETIC	REMARKS			PARTICLE SIZE CONC 1 mg																																	
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table><tr><td>A₂</td><td>3418</td><td>S</td></tr><tr><td>A₃</td><td>3330</td><td>sh</td></tr><tr><td>B₂</td><td>1640</td><td>mw</td></tr><tr><td>C</td><td>1430</td><td>ms</td></tr><tr><td></td><td>1195</td><td>ms</td></tr><tr><td>D₁</td><td>1075</td><td>S</td></tr><tr><td></td><td>995</td><td>S</td></tr><tr><td>D₂</td><td>640</td><td>ms</td></tr><tr><td></td><td>505</td><td>S</td></tr><tr><td>D₃</td><td>475</td><td>S</td></tr><tr><td></td><td>350</td><td>mw</td></tr></table>	A ₂	3418	S	A ₃	3330	sh	B ₂	1640	mw	C	1430	ms		1195	ms	D ₁	1075	S		995	S	D ₂	640	ms		505	S	D ₃	475	S		350	mw
A ₂	3418	S																																			
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D ₁	1075	S																																			
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D ₂	640	ms																																			
	505	S																																			
D ₃	475	S																																			
	350	mw																																			

MINERAL NAME H ⁺ O ⁺ JAROSITE 3		SUB GROUP		GROUP ALUNITE		CLASS SULFATES		SPECTRA NO A212	
HYDRONIUM JAROSITE		CHEMICAL FORMULA (IDEAL) (H ₃ O ⁺)Fe ₃ (SO ₄) ₂ (OH) ₆				CHEMICAL FORMULA (ACTUAL)			
CRYSTAL SYSTEM TRIGONAL		SPACE GROUP R3m (160)		a: 7.35 β:		b: 17.00 γ:		Z: 3 D: 3.003	
ORIGIN OF SAMPLE SYNTHETIC				REMARKS				PARTICLE SIZE 1 mg	
								MAJOR ABSORPTION BANDS (cm ⁻¹)	
								A A ₃ 3310 s	
								B B ₂ 1638 m	
								1175 sh	
								D ₁ 1087 s	
								1003	
								D ₂ 619 ms	
								D 503 s	
								D ₃ 463	
								338 mw	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																					
BASALUMINITE			SULFATES	218																																																					
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																							
$\text{Al}_4(\text{SO}_4)(\text{OH})_{10} \cdot 5\text{H}_2\text{O}$																																																									
CRYSTAL SYSTEM	SPACE GROUP	a: 22.56 α:	b: 18.72 β:	c: 18.72 γ: Z: 24 D: 2.24																																																					
Possibly HEXAGONAL	()																																																								
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																																					
From Pei-Lin Tien, Univ. KANSAS				1.5 mg																																																					
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																																						
			<table><tr><td></td><td>A₁</td><td>3608</td><td>s</td></tr><tr><td>A</td><td>A₃</td><td>3390</td><td>s</td></tr><tr><td>B</td><td>B₂</td><td>1650</td><td>mw</td></tr><tr><td></td><td></td><td>1180</td><td>sh w</td></tr><tr><td></td><td></td><td>1100</td><td>s</td></tr><tr><td></td><td>D₁</td><td>1035</td><td>w</td></tr><tr><td></td><td></td><td>954</td><td>m</td></tr><tr><td></td><td>D₂</td><td>755</td><td>ms</td></tr><tr><td></td><td></td><td>607</td><td>w</td></tr><tr><td></td><td></td><td>548</td><td>m</td></tr><tr><td></td><td></td><td>503</td><td></td></tr><tr><td>D</td><td>D₃</td><td>470</td><td>mw</td></tr><tr><td></td><td></td><td>395</td><td>w</td></tr><tr><td></td><td></td><td>383</td><td></td></tr></table>			A ₁	3608	s	A	A ₃	3390	s	B	B ₂	1650	mw			1180	sh w			1100	s		D ₁	1035	w			954	m		D ₂	755	ms			607	w			548	m			503		D	D ₃	470	mw			395	w	
	A ₁	3608	s																																																						
A	A ₃	3390	s																																																						
B	B ₂	1650	mw																																																						
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		503																																																							
D	D ₃	470	mw																																																						
		395	w																																																						
		383																																																							

MINERAL NAME ALUMINITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO 190																																																			
CHEMICAL FORMULA (IDEAL) $Al_2(SO_4)(OH)_4 \cdot 7H_2O$		CHEMICAL FORMULA (ACTUAL)																																																					
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:																																																			
ORIGIN OF SAMPLE Newhaven, Sussex, ENGLAND	REMARKS		PARTICLE SIZE	CONC 0.7 mg																																																			
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																																				
			<table border="0"> <tr><td>A₂</td><td>3540</td><td>sh</td></tr> <tr><td>A</td><td>A₃</td><td>3370</td><td rowspan="2">sh</td></tr> <tr><td></td><td>A₄</td><td>3150</td></tr> <tr><td>B</td><td>B₂</td><td>1690</td><td>ms</td></tr> <tr><td></td><td></td><td>1640</td><td>sh</td></tr> <tr><td></td><td>D₁</td><td>1170</td><td>sh</td></tr> <tr><td></td><td></td><td>1075</td><td>s</td></tr> <tr><td></td><td></td><td>975</td><td>ms</td></tr> <tr><td>D</td><td>D₂</td><td>820</td><td>w</td></tr> <tr><td></td><td></td><td>635</td><td>s</td></tr> <tr><td></td><td></td><td>590</td><td></td></tr> <tr><td></td><td>D₃</td><td>515</td><td>w</td></tr> <tr><td></td><td></td><td>407</td><td>w</td></tr> <tr><td></td><td></td><td>312</td><td>m</td></tr> </table>		A ₂	3540	sh	A	A ₃	3370	sh		A ₄	3150	B	B ₂	1690	ms			1640	sh		D ₁	1170	sh			1075	s			975	ms	D	D ₂	820	w			635	s			590			D ₃	515	w			407	w	
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		407	w																																																				
		312	m																																																				

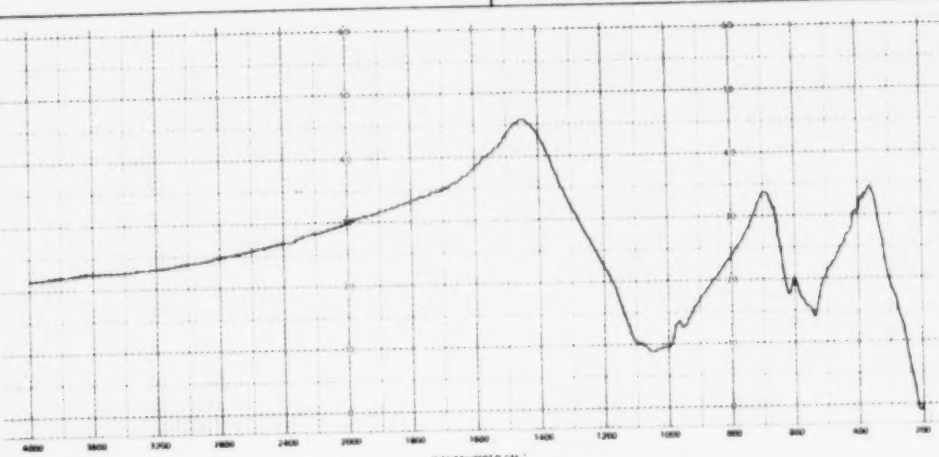
MINERAL NAME COPIAPITE	SUB GROUP	GROUP	CLASS SULFATES	SPECTRA NO A302																																									
CHEMICAL FORMULA (IDEAL) $Fe^{2+}Fe_4^{3+}(SO_4)_6(OH)_2 \cdot 2H_2O$		CHEMICAL FORMULA (ACTUAL)																																											
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P$\bar{1}$ (2)	a: 7.251 α : 93°59'	b: 18.161 β : 102°17'	c: 7.267 γ : 97°58' Z: 1 D: 2.163																																									
ORIGIN OF SAMPLE GSC 18871	REMARKS		PARTICLE SIZE	CONC 2 mg																																									
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																										
			<table border="0"> <tr><td>A</td><td>A₃</td><td>3500</td><td rowspan="2">br</td><td rowspan="2">s</td></tr> <tr><td></td><td>A₄</td><td>3200</td></tr> <tr><td>B</td><td>B₂</td><td>1655</td><td>ms</td></tr> <tr><td></td><td></td><td>1215</td><td rowspan="2">)</td><td rowspan="2">s</td></tr> <tr><td>D₁</td><td></td><td>1125</td></tr> <tr><td></td><td></td><td>1000</td><td>s</td></tr> <tr><td>D₂</td><td></td><td>600</td><td rowspan="2">)</td><td rowspan="2">ms</td></tr> <tr><td></td><td></td><td>555</td></tr> <tr><td></td><td></td><td>455</td><td>m</td></tr> <tr><td>D₃</td><td></td><td>415</td><td rowspan="2">)</td><td rowspan="2">w</td></tr> <tr><td></td><td></td><td>300</td></tr> </table>		A	A ₃	3500	br	s		A ₄	3200	B	B ₂	1655	ms			1215	)	s	D ₁		1125			1000	s	D ₂		600	)	ms			555			455	m	D ₃		415	)	w
A	A ₃	3500	br	s																																									
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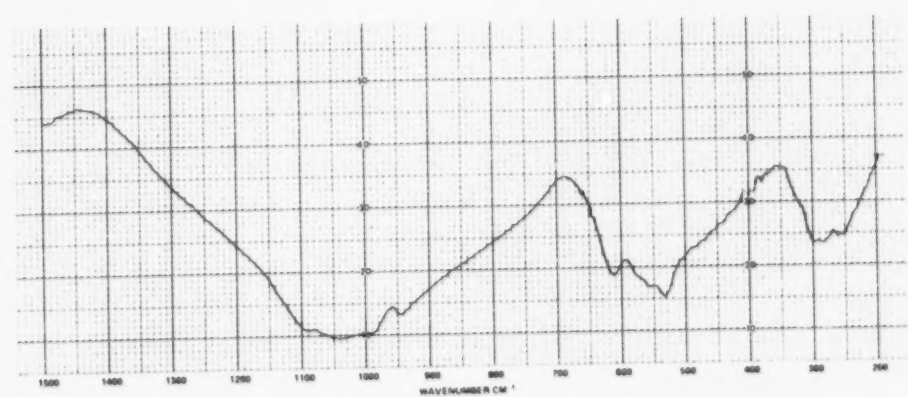
MINERAL NAME TRIPHYLLITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 280																																
CHEMICAL FORMULA (IDEAL) $\text{Li}(\text{Fe}, \text{Mn})(\text{PO}_4)$		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pmnb (62)	a: 6.029 α :	b: 10.359 β :	c: 4.703 γ : Z: 4 D: 3.423																																
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC 3mg																																	
		MAJOR ABSORPTION BANDS (cm^{-1})																																		
		<table> <tr><td>D₁</td><td>1136</td><td rowspan="4">sh</td><td rowspan="4">s</td></tr> <tr><td></td><td>1092</td></tr> <tr><td></td><td>1045</td></tr> <tr><td></td><td>985</td></tr> <tr><td>D₂</td><td>636</td><td></td><td></td></tr> <tr><td></td><td>571</td><td></td><td></td></tr> <tr><td></td><td>545</td><td></td><td></td></tr> <tr><td></td><td>461</td><td></td><td></td></tr> <tr><td>D₃</td><td>361</td><td>sh</td><td></td></tr> <tr><td></td><td>336</td><td></td><td></td></tr> </table>			D ₁	1136	sh	s		1092		1045		985	D ₂	636				571				545				461			D ₃	361	sh			336
D ₁	1136	sh	s																																	
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	336																																			

MINERAL NAME TRIPHYLLITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 280
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm^{-1})		

MINERAL NAME PURPURITE		SUB GROUP		GROUP		CLASS PHOSPHATE		SPECTRA NO 276																			
CHEMICAL FORMULA (IDEAL) Mn⁺³PO₄				CHEMICAL FORMULA (ACTUAL)																							
CRYSTAL SYSTEM ORTHORHOMBIC		SPACE GROUP Pmm (62)		a: 5.83 α:		b: 9.70 β:		c: 4.77 γ:																			
				Z: 4		D: 3.69																					
ORIGIN OF SAMPLE Kleinspitzkoppe S.W. AFRICA				REMARKS				PARTICLE SIZE 1 mg																			
						MAJOR ABSORPTION BANDS (cm ⁻¹)																					
						<table border="0"> <tr> <td>D₁</td> <td>1080</td> <td>s</td> </tr> <tr> <td></td> <td>1018</td> <td>s</td> </tr> <tr> <td></td> <td>960</td> <td></td> </tr> <tr> <td>D</td> <td>673 'sh</td> <td></td> </tr> <tr> <td>D₂</td> <td>650</td> <td>m</td> </tr> <tr> <td></td> <td>532</td> <td>ms</td> </tr> <tr> <td>D₃</td> <td>396</td> <td>ms</td> </tr> <tr> <td></td> <td>325</td> <td>mw</td> </tr> </table>				D ₁	1080	s		1018	s		960		D	673 'sh		D ₂	650	m		532	ms
D ₁	1080	s																									
	1018	s																									
	960																										
D	673 'sh																										
D ₂	650	m																									
	532	ms																									
D ₃	396	ms																									
	325	mw																									

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																			
WHITLOCKITE			PHOSPHATES	A281																																			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																					
$\text{Ca}_3(\text{PO}_4)_2 / \text{Caq}(\text{Mg}, \text{Fe})\text{H}(\text{PO}_4)_7$																																							
CRYSTAL SYSTEM	SPACE GROUP	a: 10.37 α :	b: 37.19 β :	c: 37.19 γ :																																			
TRIGONAL	$R\bar{3}c$ (167)			Z: 21(7) D: 3.568																																			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																			
GSC 18942				2 mg																																			
			MAJOR ABSORPTION BANDS (cm^{-1})																																				
			<table> <tr> <td></td> <td>1135</td> <td rowspan="4">max.</td> <td rowspan="4">s</td> </tr> <tr> <td></td> <td>1060</td> </tr> <tr> <td></td> <td>1021</td> </tr> <tr> <td></td> <td>990</td> </tr> <tr> <td>D_1</td> <td>958</td> <td></td> <td></td> </tr> <tr> <td></td> <td>919</td> <td></td> <td></td> </tr> <tr> <td>D_2</td> <td>601</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td>556</td> <td></td> <td>s</td> </tr> <tr> <td></td> <td>540</td> <td>sh</td> <td></td> </tr> <tr> <td>D_3</td> <td>450</td> <td></td> <td>s</td> </tr> <tr> <td></td> <td>300</td> <td></td> <td></td> </tr> </table>			1135	max.	s		1060		1021		990	D_1	958				919			D_2	601		ms		556		s		540	sh		D_3	450		s	
	1135	max.	s																																				
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	540	sh																																					
D_3	450		s																																				
	300																																						

MINERAL NAME MONAZITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 257															
CHEMICAL FORMULA (IDEAL) (Ce, La, Nd, Th) PO₄		CHEMICAL FORMULA (ACTUAL)																	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP P2₁/n (14)	a: 6.796 α:	b: 7.006 β: 103°58' γ:	c: 6.466 Z: 4 D: 5.06															
ORIGIN OF SAMPLE Iveland, NORWAY	REMARKS		PARTICLE SIZE	CONC. 5 mg															
			MAJOR ABSORPTION BANDS (cm ⁻¹)																
			<table border="0"> <tr> <td></td> <td>1090 sh</td> <td></td> </tr> <tr> <td>D₁</td> <td>1040</td> <td>S</td> </tr> <tr> <td></td> <td>993</td> <td></td> </tr> <tr> <td>D</td> <td>945</td> <td>W</td> </tr> <tr> <td>D₂</td> <td>613</td> <td>mw</td> </tr> <tr> <td>D₃</td> <td>535</td> <td>ms</td> </tr> </table>			1090 sh		D ₁	1040	S		993		D	945	W	D ₂	613	mw
	1090 sh																		
D ₁	1040	S																	
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D ₃	535	ms																	

MINERAL NAME MONAZITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 257
CHEMICAL FORMULA (IDEAL) (Ce, La, Nd, Th) PO₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a:	b:	c:
		α:	β:	γ:
Z:	D:			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME VARISCITE	SUB GROUP	GROUP VARISCITE	CLASS PHOSPHATES	SPECTRA NO. A235																									
CHEMICAL FORMULA (IDEAL) $\text{AlPO}_4 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																											
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pcab (61)	a: 9.87 α:	b: 9.57 β:	c: 8.52 γ: Z: 8 D: 2.61																									
ORIGIN OF SAMPLE Amatrice, Utah, U.S.A.	REMARKS		PARTICLE SIZE	CONC. 2 mg																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																										
			<table border="1"> <tr><td>3598</td><td>s</td></tr> <tr><td>3100</td><td>s</td></tr> <tr><td>2950</td><td>sh</td></tr> <tr><td>1578</td><td>m</td></tr> <tr><td>1154</td><td>m</td></tr> <tr><td>1068</td><td>sh</td></tr> <tr><td>1035</td><td>s</td></tr> <tr><td>931</td><td>m</td></tr> <tr><td>866</td><td>w</td></tr> <tr><td>793</td><td>mw</td></tr> <tr><td>697</td><td>w</td></tr> <tr><td>633</td><td>w</td></tr> <tr><td>602</td><td>w</td></tr> <tr><td>569</td><td>mw</td></tr> </table>		3598	s	3100	s	2950	sh	1578	m	1154	m	1068	sh	1035	s	931	m	866	w	793	mw	697	w	633	w	602
3598	s																												
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602	w																												
569	mw																												

MINERAL NAME VARISCITE	SUB GROUP	GROUP VARISCITE	CLASS PHOSPHATES	SPECTRA NO. A235							
CHEMICAL FORMULA (IDEAL) $\text{AlPO}_4 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)									
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:							
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC. mg							
			MAJOR ABSORPTION BANDS (cm⁻¹)								
			<table border="1"> <tr><td>508</td><td>mw</td></tr> <tr><td>443</td><td>ms</td></tr> <tr><td>380</td><td>w</td></tr> <tr><td>347</td><td>sh</td></tr> <tr><td>309</td><td>w</td></tr> </table>		508	mw	443	ms	380	w	347
508	mw										
443	ms										
380	w										
347	sh										
309	w										

MINERAL NAME STRENGITE	SUB GROUP	GROUP VARISCITE	CLASS PHOSPHATES	SPECTRA NO. 270																																	
CHEMICAL FORMULA (IDEAL) $\text{Fe}^{+3}\text{PO}_4 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																			
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pcab (61)	a: 10.05 α:	b: 9.92 β:	c: 8.74 γ:																																	
		Z: 8	D: 2.848																																		
ORIGIN OF SAMPLE Bullmoose, S. Dakota, U.S.A.		REMARKS	PARTICLE SIZE	CONC 1 mg																																	
			MAJOR ABSORPTION BANDS (cm^{-1})																																		
			<table border="0"> <tr><td>A₃</td><td>3380</td><td>s</td></tr> <tr><td>A₄</td><td>3100</td><td>s</td></tr> <tr><td>B₂</td><td>1624</td><td>s</td></tr> <tr><td></td><td>1115 sh</td><td></td></tr> <tr><td>D₁</td><td>1013</td><td>s</td></tr> <tr><td></td><td>992</td><td></td></tr> <tr><td>D₂</td><td>754</td><td>mw</td></tr> <tr><td></td><td>575</td><td></td></tr> <tr><td></td><td>540</td><td>ms</td></tr> <tr><td>D₃</td><td>456</td><td></td></tr> <tr><td></td><td>375</td><td></td></tr> <tr><td></td><td>308</td><td>ms</td></tr> </table>		A ₃	3380	s	A ₄	3100	s	B ₂	1624	s		1115 sh		D ₁	1013	s		992		D ₂	754	mw		575			540	ms	D ₃	456			375	
A ₃	3380	s																																			
A ₄	3100	s																																			
B ₂	1624	s																																			
	1115 sh																																				
D ₁	1013	s																																			
	992																																				
D ₂	754	mw																																			
	575																																				
	540	ms																																			
D ₃	456																																				
	375																																				
	308	ms																																			

MINERAL NAME METAVARISCITE	SUB GROUP	GROUP METAVARISCITE	CLASS PHOSPHATES	SPECTRA NO. A296																																													
CHEMICAL FORMULA (IDEAL) $\text{Al}(\text{PO}_4) \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																															
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP P2₁/n (14)	a: 8.47 α:	b: 9.47 β: -90°	c: 5.16 γ:																																													
		Z: 4	D: 2.535																																														
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC mg																																													
			MAJOR ABSORPTION BANDS (cm^{-1})																																														
			<table border="0"> <tr><td>A₂</td><td>3592</td><td>s</td></tr> <tr><td>A₃</td><td>3378</td><td>w</td></tr> <tr><td>A₄</td><td>3100</td><td>s</td></tr> <tr><td>B₁</td><td>1630</td><td></td></tr> <tr><td></td><td>1152 sh</td><td></td></tr> <tr><td>D₁</td><td>1070</td><td>s</td></tr> <tr><td></td><td>931</td><td></td></tr> <tr><td></td><td>864</td><td>w</td></tr> <tr><td>D₂</td><td>796</td><td>m</td></tr> <tr><td></td><td>777</td><td></td></tr> <tr><td>D₃</td><td>691</td><td>mw</td></tr> <tr><td></td><td>640</td><td>w</td></tr> <tr><td></td><td>603</td><td>w</td></tr> <tr><td></td><td>566</td><td></td></tr> <tr><td></td><td>502</td><td></td></tr> <tr><td></td><td>453</td><td>ms</td></tr> </table>		A ₂	3592	s	A ₃	3378	w	A ₄	3100	s	B ₁	1630			1152 sh		D ₁	1070	s		931			864	w	D ₂	796	m		777		D ₃	691	mw		640	w		603	w		566			502	
A ₂	3592	s																																															
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D ₁	1070	s																																															
	931																																																
	864	w																																															
D ₂	796	m																																															
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D ₃	691	mw																																															
	640	w																																															
	603	w																																															
	566																																																
	502																																																
	453	ms																																															

MINERAL NAME AMBLYGONITE	SUB GROUP	GROUP AMBLYGONITE	CLASS PHOSPHATES	SPECTRA NO 253																													
CHEMICAL FORMULA (IDEAL) (Li, Na) Al(PO ₄)(F, OH)		CHEMICAL FORMULA (ACTUAL)																															
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P $\bar{1}$ (2)	a: 5.148 α : 113.97°	b: 7.215 β : 98.64°	c: 5.060 γ : 67.25° Z: 2 D: 3.065																													
ORIGIN OF SAMPLE Black Hill, S. Dakota, U.S.A.	REMARKS		PARTICLE SIZE	CONC 3 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table> <tr> <td>A</td> <td>A₃</td> <td>3375</td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>1098</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1019</td> <td></td> </tr> <tr> <td></td> <td>D₂</td> <td>818</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>637</td> <td></td> </tr> <tr> <td>D</td> <td></td> <td>590</td> <td></td> </tr> <tr> <td></td> <td>D₃</td> <td>478</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>407</td> <td></td> </tr> </table>		A	A ₃	3375	ms		D ₁	1098	s			1019			D ₂	818	m			637		D		590			D ₃	478	ms	
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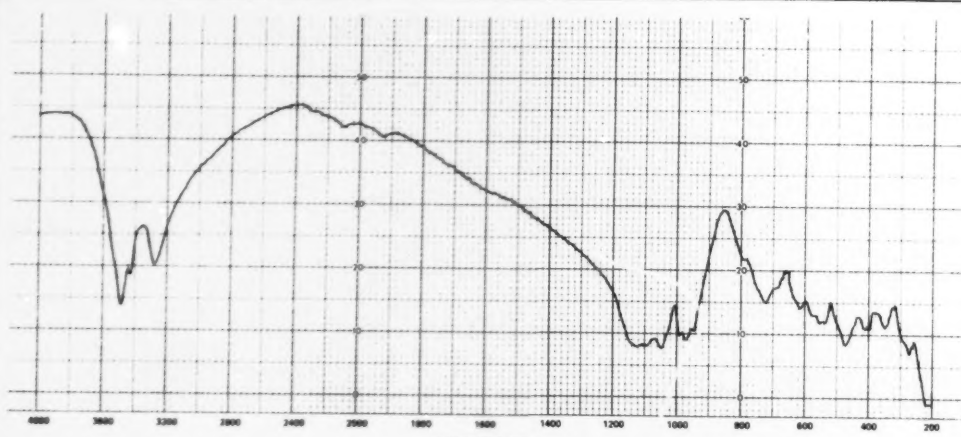
MINERAL NAME AMBLYGONITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 253'
CHEMICAL FORMULA (IDEAL) (Li, Na) Al (PO ₄)(F, OH)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

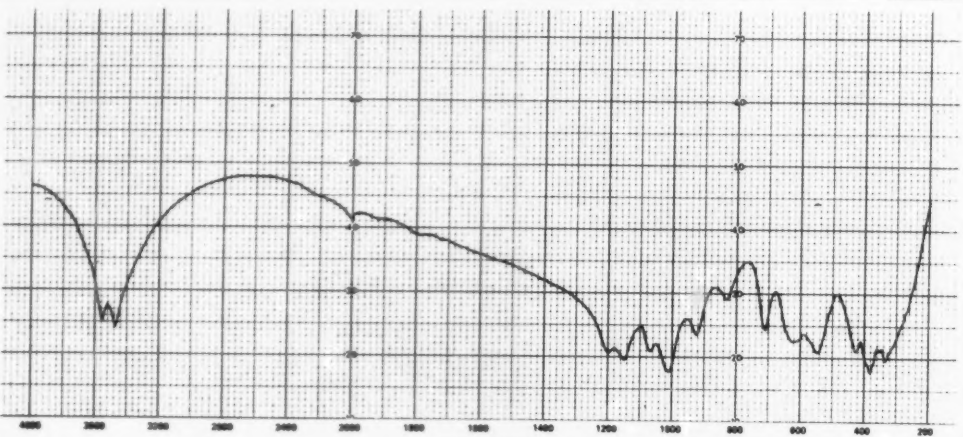
MINERAL NAME PLUMBOGUMMITE	SUB GROUP	GROUP PLUMBOGUMMITE	CLASS	SPECTRA NO A286																																													
CHEMICAL FORMULA (IDEAL) $\text{PbAl}_3(\text{PO}_4)_2(\text{OH})_5 \cdot \text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																															
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $R\bar{3}m$ (166)	a: 7.018 α :	b: β :	c: 16.784 γ : Z: 3 D: 3.951																																													
ORIGIN OF SAMPLE GSC 18658	REMARKS		PARTICLE SIZE	CONC 2 mg																																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																																														
			<table> <tr><td>A</td><td>A₂</td><td>3600</td><td>sh</td></tr> <tr><td></td><td></td><td>3400</td><td>sh</td></tr> <tr><td></td><td>A₄</td><td>3110</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1657</td><td>ms</td></tr> <tr><td></td><td></td><td>1183</td><td>sh</td></tr> <tr><td></td><td>D₁</td><td>1098</td><td>sh</td></tr> <tr><td></td><td></td><td>1021</td><td>s</td></tr> <tr><td></td><td>D₂</td><td>820</td><td>m</td></tr> <tr><td></td><td></td><td>582</td><td>s</td></tr> <tr><td></td><td></td><td>491</td><td>w</td></tr> <tr><td></td><td>D₃</td><td>435</td><td>w</td></tr> <tr><td></td><td></td><td>355</td><td>ms</td></tr> </table>		A	A ₂	3600	sh			3400	sh		A ₄	3110	s	B	B ₂	1657	ms			1183	sh		D ₁	1098	sh			1021	s		D ₂	820	m			582	s			491	w		D ₃	435	w	
A	A ₂	3600	sh																																														
		3400	sh																																														
	A ₄	3110	s																																														
B	B ₂	1657	ms																																														
		1183	sh																																														
	D ₁	1098	sh																																														
		1021	s																																														
	D ₂	820	m																																														
		582	s																																														
		491	w																																														
	D ₃	435	w																																														
		355	ms																																														

MINERAL NAME GOYAZITE	SUB GROUP	GROUP CRANDALLITE $\text{CaAl}_3(\text{PO}_4)_2(\text{OH})_5 \cdot \text{H}_2\text{O}$	CLASS PHOSPHATES	SPECTRA NO 263																																									
CHEMICAL FORMULA (IDEAL) $\text{SrAl}_3(\text{PO}_4)_2(\text{OH})_5 \cdot \text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																											
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP $R\bar{3}m$ (166)	a: 6.981 α :	b: 16.487 β :	c: γ : Z: 3 D: 3.304																																									
ORIGIN OF SAMPLE Eagle Peakmine, Colorado, U.S.A.	REMARKS		PARTICLE SIZE	CONC 3 mg																																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																																										
			<table> <tr><td>A</td><td>A₂</td><td>2440</td><td>w</td></tr> <tr><td></td><td></td><td>1142</td><td>sh</td></tr> <tr><td></td><td>D₁</td><td>1008</td><td>s</td></tr> <tr><td></td><td></td><td>768</td><td>m</td></tr> <tr><td></td><td>D₂</td><td>721</td><td>m</td></tr> <tr><td></td><td></td><td>640</td><td>mw</td></tr> <tr><td>D</td><td></td><td>577</td><td>ms</td></tr> <tr><td></td><td></td><td>533</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>417</td><td>ms</td></tr> <tr><td></td><td></td><td>367</td><td>mw</td></tr> <tr><td></td><td></td><td>319</td><td>w</td></tr> </table>		A	A ₂	2440	w			1142	sh		D ₁	1008	s			768	m		D ₂	721	m			640	mw	D		577	ms			533	ms		D ₃	417	ms			367	mw	
A	A ₂	2440	w																																										
		1142	sh																																										
	D ₁	1008	s																																										
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D		577	ms																																										
		533	ms																																										
	D ₃	417	ms																																										
		367	mw																																										
		319	w																																										

MINERAL NAME TRIPLITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 268																
CHEMICAL FORMULA (IDEAL) (Mn, Fe, Mg, Ca)₂(PO₄)(F, OH)		CHEMICAL FORMULA (ACTUAL)																		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP 12/m (12)	a: 12.085 α:	b: 6.536 β: 105°38'	c: 9.910 γ:																
ORIGIN OF SAMPLE Bimbawme, S. AUSTRALIA		REMARKS		PARTICLE SIZE 3 mg																
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3490</td> <td>w</td> </tr> <tr> <td>D</td> <td>D₁</td> <td>1040</td> <td>s</td> </tr> <tr> <td></td> <td>D₂</td> <td>578</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>456</td> <td>mw</td> </tr> </table>	A	A ₂	3490	w	D	D ₁	1040	s		D ₂	578	s			456	mw
A	A ₂	3490	w																	
D	D ₁	1040	s																	
	D ₂	578	s																	
		456	mw																	

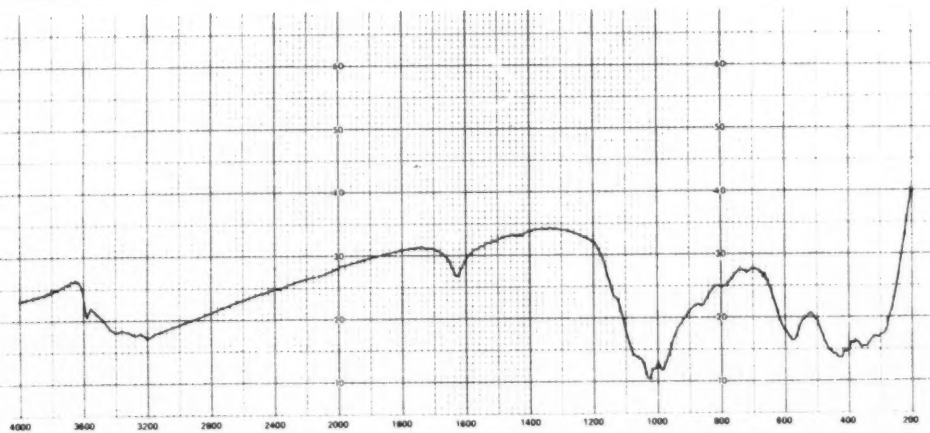
MINERAL NAME TRIPLITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO 268'																
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:																
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE mg																
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3490</td> <td>w</td> </tr> <tr> <td>D</td> <td>D₁</td> <td>1040</td> <td>s</td> </tr> <tr> <td></td> <td>D₂</td> <td>578</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>456</td> <td>mw</td> </tr> </table>	A	A ₂	3490	w	D	D ₁	1040	s		D ₂	578	s			456	mw
A	A ₂	3490	w																	
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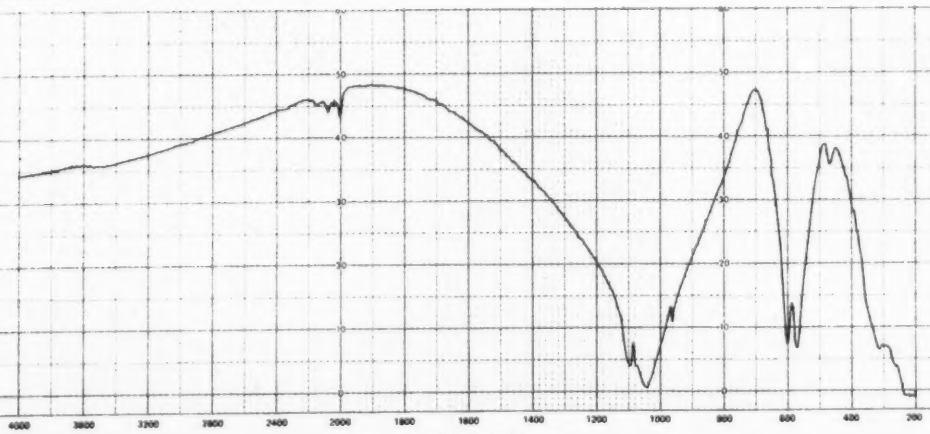
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
BRAZILIANITE			PHOSPHATES	267
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
NaAl ₃ (PO ₄) ₂ (OH) ₄				
CRYSTAL SYSTEM	SPACE GROUP			
MONOCLINIC	P2 ₁ /m (14)	a: 11.21 α:	b: 10.10 β: 97°22' γ:	c: 7.07 Z: 4 D: 3.027
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
Corrego Frio, Saotome Minas, Gerais, BRAZIL				3 mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			A	
			A ₂ 3470) 3415/sh) s	
			A ₃ 3261) ms	
			1115) 1090) s	
			D ₁ 1042) 986) 965) s 943)	
			715 m	
			D ₂ 612 w 550 w	
			471 mw	
			D ₃ 412 w 347 w	

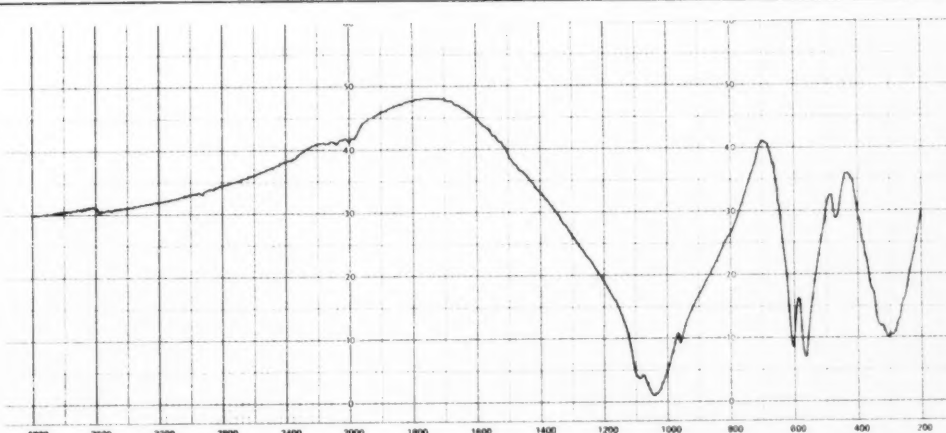
MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO		
AUGELITE			PHOSPHATES	A278		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
Al ₂ (PO ₄)(OH) ₃						
CRYSTAL SYSTEM	SPACE GROUP					
MONOCLINIC	C2/m (12)					
a: 13.063		b: 7.993		c: 5.073		
α:		β: 112° 7.8'		γ:		
Z: 4		D: 2.707				
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
GSC 18422				2 mg		
			MAJOR ABSORPTION BANDS (cm⁻¹)			
			A	A ₂	3561	s
					3478	
					1199	m
					1150	m
	D ₁	1069	mw			
		1011	s			
		925	m			
		837	mw			
	D ₂	711	ms			
		621	mw			
		549	ms			
	D ₃	428				
		383	ms			
		339				

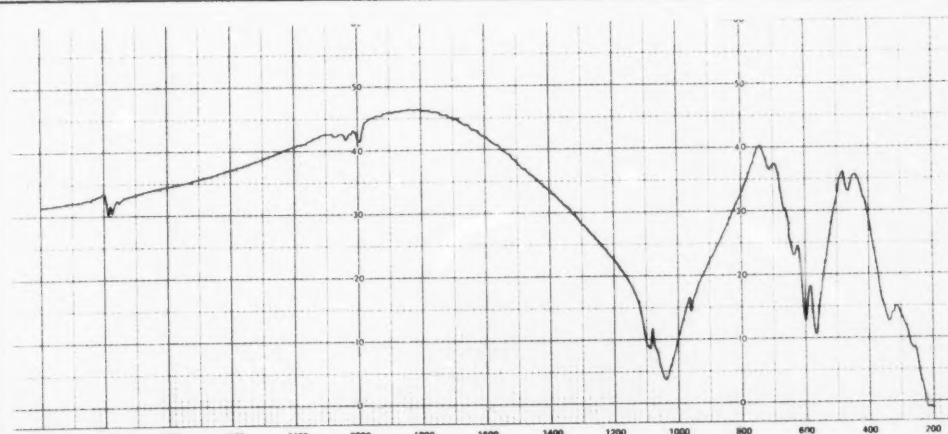
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO															
APATITE		APATITE	PHOSPHATES	252															
FLUORAPATITE	CHEMICAL FORMULA (IDEAL) $A_5(PO_4)_3(F, OH, Cl)$ $A = Ca, Sr, Ba, Pb, Na, Ce,$		CHEMICAL FORMULA (ACTUAL)																
CRYSTAL SYSTEM	SPACE GROUP	a: 9.3684 α:	b: β:	c: 6.8841 γ:															
HEXAGONAL	P6/m (176)		Z: 2	D: 3.201															
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC															
Cerro De Mercado Durango, MEXICO				3 mg															
			MAJOR ABSORPTION BANDS (cm⁻¹)																
			<table> <tr> <td>D₁</td> <td>1092</td> <td rowspan="3">)</td> <td rowspan="3">s</td> </tr> <tr> <td></td> <td>1040</td> </tr> <tr> <td></td> <td>960</td> </tr> <tr> <td>D₂</td> <td>600</td> <td rowspan="2">)</td> <td rowspan="2">s</td> </tr> <tr> <td></td> <td>570</td> </tr> <tr> <td>D₃</td> <td>465</td> <td></td> <td>w</td> </tr> </table>		D ₁	1092	)	s		1040		960	D ₂	600	)	s		570	D ₃
D ₁	1092	)	s																
	1040																		
	960																		
D ₂	600	)	s																
	570																		
D ₃	465		w																

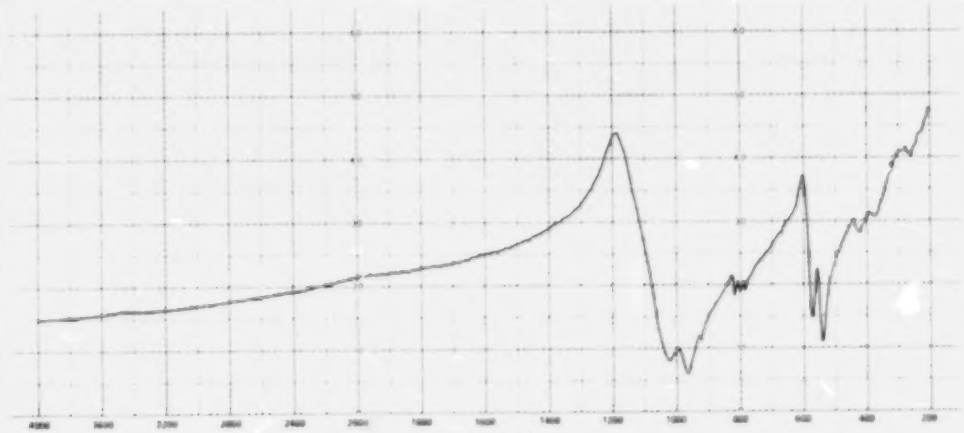
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
APATITE			PHOSPHATES	252 ¹
	CHEMICAL FORMULA (IDEAL) $Ca_5(PO_4)_3F$		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP	a: α:	b: β:	c: γ:
	()		Z:	D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
				mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

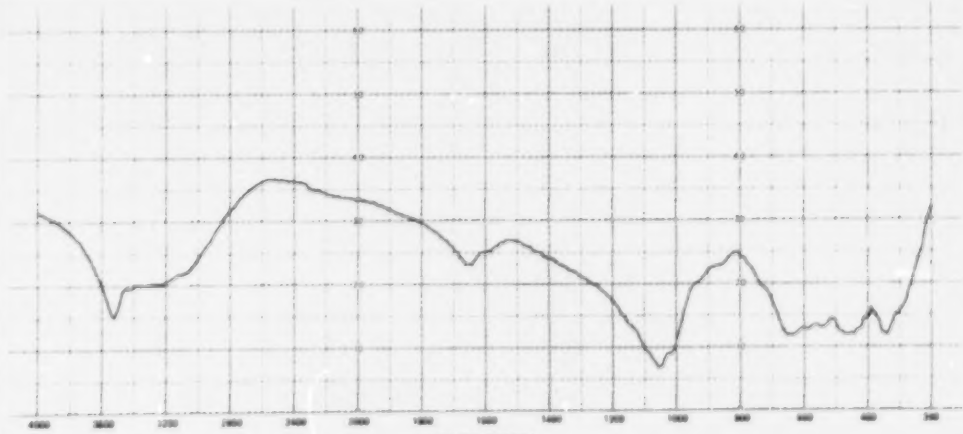
MINERAL NAME DUFRENITE	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO A289																																								
CHEMICAL FORMULA (IDEAL) $\text{Fe}^{+2}\text{Fe}^{+3}_4(\text{PO}_4)_3(\text{OH})_5 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																										
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/c (15)	a: 25.84 α:	b: 5.126 β: 111°12'	c: 13.78 γ:																																								
ORIGIN OF SAMPLE GSC 18721		REMARKS		PARTICLE SIZE 2 mg																																								
				MAJOR ABSORPTION BANDS (cm^{-1}) <table border="0"> <tr><td>A</td><td>$\overline{A_2}$</td><td>3580</td><td>sh</td></tr> <tr><td></td><td>$\overline{A_3}$</td><td>3390</td><td>sh</td></tr> <tr><td></td><td>$\overline{A_4}$</td><td>3195</td><td>ms</td></tr> <tr><td>B</td><td>$\overline{B_2}$</td><td>1625</td><td>m</td></tr> <tr><td></td><td></td><td>1055</td><td>sh</td></tr> <tr><td>D</td><td>$\overline{D_1}$</td><td>1025</td><td>s</td></tr> <tr><td></td><td></td><td>984</td><td>mw</td></tr> <tr><td></td><td></td><td>570</td><td>ms</td></tr> <tr><td></td><td>$\overline{D_3}$</td><td>425</td><td>ms</td></tr> <tr><td></td><td></td><td>352</td><td>mw</td></tr> </table>	A	$\overline{A_2}$	3580	sh		$\overline{A_3}$	3390	sh		$\overline{A_4}$	3195	ms	B	$\overline{B_2}$	1625	m			1055	sh	D	$\overline{D_1}$	1025	s			984	mw			570	ms		$\overline{D_3}$	425	ms			352	mw
A	$\overline{A_2}$	3580	sh																																									
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D	$\overline{D_1}$	1025	s																																									
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	$\overline{D_3}$	425	ms																																									
		352	mw																																									

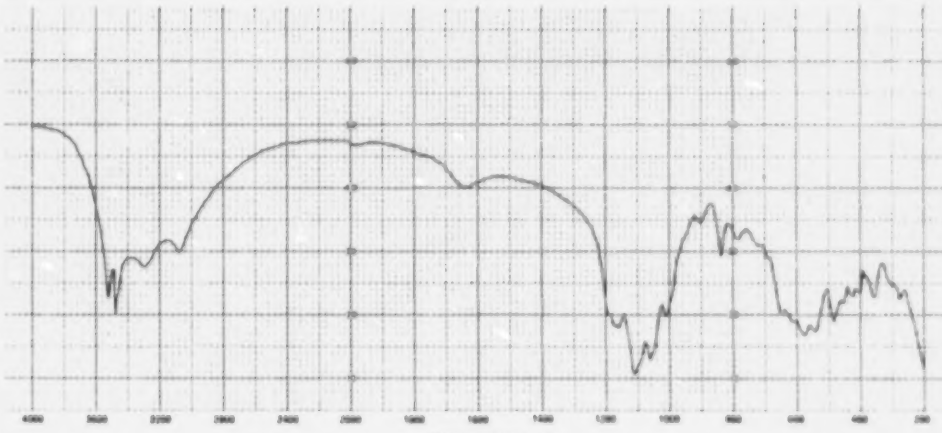
MINERAL NAME APATITE	SUB GROUP	GROUP APATITE	CLASS PHOSPHATES	SPECTRA NO 260																												
CHEMICAL FORMULA (IDEAL) FLUORAPATITE $\text{Ca}_5(\text{PO}_4)_3\text{F}$		CHEMICAL FORMULA (ACTUAL)																														
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP P6/m (175)	a: 9.3684 α:	b: β:	c: 6.8841 γ:																												
ORIGIN OF SAMPLE Ashio Mine, JAPAN		REMARKS		PARTICLE SIZE 3 mg																												
				MAJOR ABSORPTION BANDS (cm^{-1}) <table border="0"> <tr><td>D</td><td>$\overline{D_1}$</td><td>1090</td><td>sh</td></tr> <tr><td></td><td></td><td>1073</td><td>s</td></tr> <tr><td></td><td></td><td>1040</td><td>s</td></tr> <tr><td></td><td></td><td>960</td><td>s</td></tr> <tr><td>D</td><td>$\overline{D_3}$</td><td>598</td><td>s</td></tr> <tr><td></td><td></td><td>569</td><td>s</td></tr> <tr><td></td><td></td><td>464</td><td>w</td></tr> </table>	D	$\overline{D_1}$	1090	sh			1073	s			1040	s			960	s	D	$\overline{D_3}$	598	s			569	s			464	w
D	$\overline{D_1}$	1090	sh																													
		1073	s																													
		1040	s																													
		960	s																													
D	$\overline{D_3}$	598	s																													
		569	s																													
		464	w																													

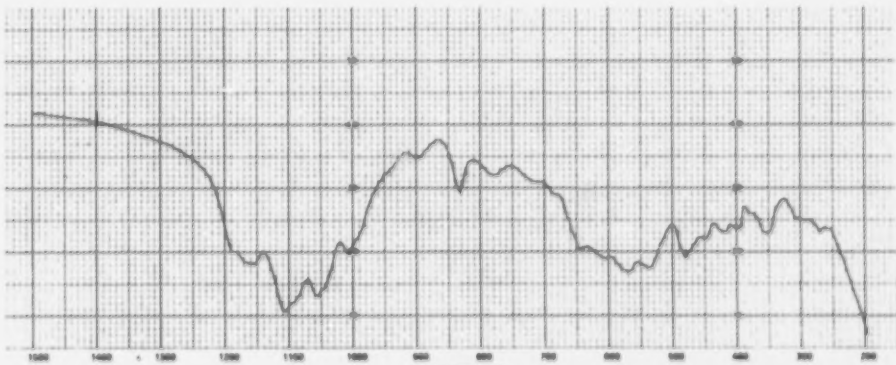
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																		
CHLORAPATITE		APATITE	PHOSPHATES	274																		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																				
Ca ₅ (PO ₄) ₃ Cl																						
CRYSTAL SYSTEM	SPACE GROUP	a: 9.634	b: 6.778	Z: 2																		
HEXAGONAL	P6/m (175)	α:	β:	D: 3.174																		
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC																		
Snarum, NORWAY				3 mg																		
			MAJOR ABSORPTION BANDS (cm ⁻¹)																			
			<table><tr><td></td><td>1083</td><td></td></tr><tr><td>D₁</td><td>1038</td><td>s</td></tr><tr><td></td><td>957</td><td></td></tr><tr><td>D₂</td><td>602</td><td>s</td></tr><tr><td></td><td>564</td><td></td></tr><tr><td></td><td>467</td><td>mw</td></tr><tr><td>D₃</td><td>302</td><td>ms</td></tr></table>			1083		D ₁	1038	s		957		D ₂	602	s		564			467	mw
	1083																					
D ₁	1038	s																				
	957																					
D ₂	602	s																				
	564																					
	467	mw																				
D ₃	302	ms																				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																								
HYDROXYAPATITE		APATITE	PHOSPHATES	261																																								
	CHEMICAL FORMULA (IDEAL) $\text{Ca}_5(\text{PO}_4)_3(\text{OH})$		CHEMICAL FORMULA (ACTUAL)																																									
CRYSTAL SYSTEM	SPACE GROUP	a: 9.418 α :	b: β :	c: 6.884 γ :																																								
HEXAGONAL	P6 ₃ /m (176)			Z: 2 D: 3.16																																								
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE CONC																																								
Holly Springs, GEORGIA, USA				3 mg																																								
				MAJOR ABSORPTION BANDS (cm ⁻¹)																																								
				<table><tr><td>A</td><td>A₂</td><td>3572</td><td>w</td></tr><tr><td></td><td></td><td>3545</td><td></td></tr><tr><td></td><td></td><td>1086</td><td></td></tr><tr><td></td><td>D₁</td><td>1037</td><td>s</td></tr><tr><td></td><td></td><td>960</td><td></td></tr><tr><td></td><td></td><td>708</td><td>w</td></tr><tr><td>D</td><td>D₂</td><td>635</td><td></td></tr><tr><td></td><td></td><td>600</td><td>s</td></tr><tr><td></td><td></td><td>565</td><td></td></tr><tr><td></td><td>D₃</td><td>463</td><td>mw</td></tr><tr><td></td><td></td><td>335</td><td></td></tr></table>	A	A ₂	3572	w			3545				1086			D ₁	1037	s			960				708	w	D	D ₂	635				600	s			565			D ₃	463	mw
A	A ₂	3572	w																																									
		3545																																										
		1086																																										
	D ₁	1037	s																																									
		960																																										
		708	w																																									
D	D ₂	635																																										
		600	s																																									
		565																																										
	D ₃	463	mw																																									
		335																																										

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																											
PYROMORPHITE			PHOSPHATES	278																											
CHEMICAL FORMULA (IDEAL)			CHEMICAL FORMULA (ACTUAL)																												
Pb ₅ (PO ₄) ₃ Cl																															
CRYSTAL SYSTEM	SPACE GROUP	a: 9.987 α:	b: β:	c: 7.330 γ:	Z: 2	D: 7.113																									
HEXAGONAL	P6 ₃ /m 176)																														
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC																									
Kamioka, Gifu, JAPAN						6 mg																									
					MAJOR ABSORPTION BANDS (cm ⁻¹)																										
					<table><tr><td>D₁</td><td>1019</td><td>S</td></tr><tr><td></td><td>959</td><td></td></tr><tr><td></td><td>919</td><td></td></tr><tr><td></td><td>813</td><td></td></tr><tr><td>D₂</td><td>799</td><td>mw</td></tr><tr><td></td><td>784</td><td></td></tr><tr><td></td><td>567</td><td>S</td></tr><tr><td></td><td>536</td><td></td></tr><tr><td>D₃</td><td>423</td><td>mw</td></tr><tr><td></td><td>380</td><td>w</td></tr></table>		D ₁	1019	S		959			919			813		D ₂	799	mw		784			567	S		536		D ₃
D ₁	1019	S																													
	959																														
	919																														
	813																														
D ₂	799	mw																													
	784																														
	567	S																													
	536																														
D ₃	423	mw																													
	380	w																													

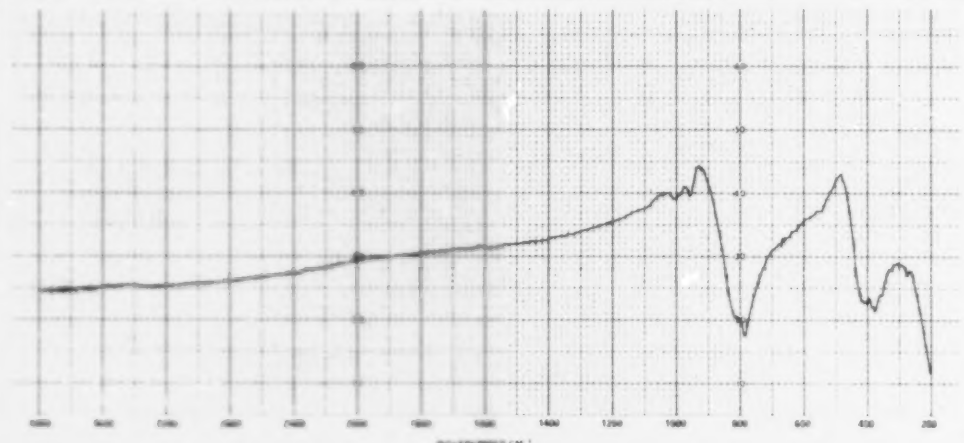
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																						
WAVELLITE			PHOSPHATES	281																																						
CHEMICAL FORMULA (IDEAL)			CHEMICAL FORMULA (ACTUAL)																																							
Al ₃ (PO ₄) ₂ (OH) ₃ ·5H ₂ O																																										
CRYSTAL SYSTEM	SPACE GROUP	a: 9.62 b: 17.34 c: 6.99 α: β: γ:	Z: 4	D: 2.37																																						
ORTHORHOMBIC	Pcmm (62)																																									
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																						
Arkansas, USA				3 mg																																						
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																							
			<table><tr><td>A</td><td>A₂</td><td>3530</td><td rowspan="2">) sh</td><td rowspan="2">ms</td></tr><tr><td></td><td>A₃</td><td>3300?</td></tr><tr><td>B</td><td>B₂</td><td>1650</td><td></td><td>m</td></tr><tr><td></td><td></td><td>1050</td><td></td><td>S</td></tr><tr><td></td><td>D₁</td><td>1015</td><td rowspan="2">) sh</td><td rowspan="2"></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td>D₂</td><td>640</td><td></td><td>ms</td></tr><tr><td></td><td></td><td>460</td><td></td><td>mw</td></tr><tr><td></td><td>D₃</td><td>338</td><td></td><td>m</td></tr></table>		A	A ₂	3530	) sh	ms		A ₃	3300?	B	B ₂	1650		m			1050		S		D ₁	1015	) sh						D ₂	640		ms			460		mw		D ₃
A	A ₂	3530	) sh	ms																																						
	A ₃	3300?																																								
B	B ₂	1650		m																																						
		1050		S																																						
	D ₁	1015	) sh																																							
	D ₂	640		ms																																						
		460		mw																																						
	D ₃	338		m																																						

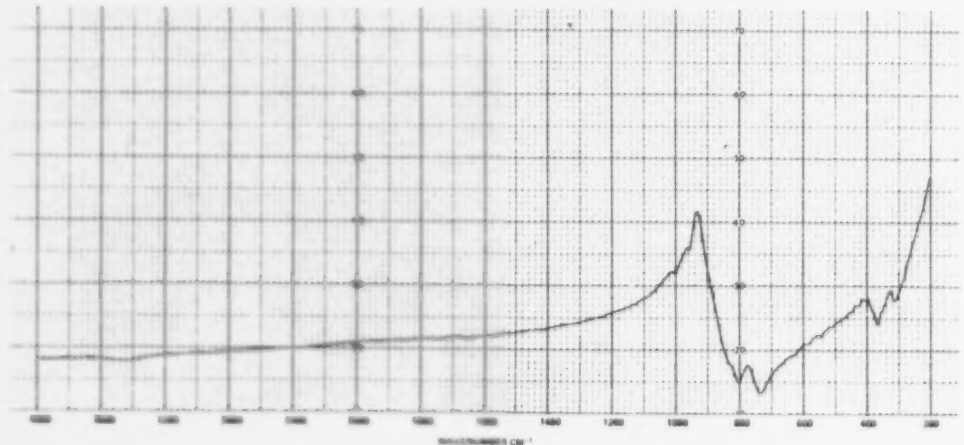
MINERAL NAME TURQUOIS	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO A218																																										
CHEMICAL FORMULA (IDEAL) $\text{CuAl}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 5\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																												
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP $\bar{P}1$ (2)	a: 7.424 α: 68.61°	b: 7.629 β: 69.71°	c: 9.910 γ: 65.08° Z: 1 D: 2.91																																										
ORIGIN OF SAMPLE Colorado, USA	REMARKS		PARTICLE SIZE	CONC 1 mg																																										
			MAJOR ABSORPTION BANDS (cm⁻¹)																																											
			<table border="0"> <tr><td>A₂</td><td>3520</td><td>S</td></tr> <tr><td>A₂</td><td>3476</td><td></td></tr> <tr><td>A₃</td><td>3460</td><td></td></tr> <tr><td>A₃</td><td>3290</td><td>MS</td></tr> <tr><td>A₄</td><td>3075</td><td></td></tr> <tr><td>B₂</td><td>1637</td><td>mw</td></tr> <tr><td></td><td>1165</td><td></td></tr> <tr><td>D₁</td><td>1108</td><td>S</td></tr> <tr><td></td><td>1057</td><td></td></tr> <tr><td></td><td>1008</td><td></td></tr> <tr><td></td><td>898</td><td>W</td></tr> <tr><td>D₂</td><td>831</td><td>m</td></tr> <tr><td></td><td>779</td><td>W</td></tr> <tr><td></td><td>569</td><td>MS</td></tr> <tr><td></td><td>536</td><td></td></tr> </table>		A ₂	3520	S	A ₂	3476		A ₃	3460		A ₃	3290	MS	A ₄	3075		B ₂	1637	mw		1165		D ₁	1108	S		1057			1008			898	W	D ₂	831	m		779	W		569	MS
A ₂	3520	S																																												
A ₂	3476																																													
A ₃	3460																																													
A ₃	3290	MS																																												
A ₄	3075																																													
B ₂	1637	mw																																												
	1165																																													
D ₁	1108	S																																												
	1057																																													
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	779	W																																												
	569	MS																																												
	536																																													

MINERAL NAME TURQUOIS	SUB GROUP	GROUP	CLASS PHOSPHATES	SPECTRA NO A218¹									
CHEMICAL FORMULA (IDEAL) $\text{CuAl}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 5\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)											
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:									
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg									
			MAJOR ABSORPTION BANDS (cm⁻¹)										
			<table border="0"> <tr><td>D₃</td><td>480</td><td></td></tr> <tr><td></td><td>420</td><td>m</td></tr> <tr><td></td><td>402</td><td></td></tr> <tr><td></td><td>353</td><td>W</td></tr> </table>		D ₃	480			420	m		402	
D ₃	480												
	420	m											
	402												
	353	W											

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																						
TINTICITE			PHOSPHATES	251																																																						
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																								
$\text{Fe}_6^{+3}(\text{PO}_4)_4(\text{OH})_6 \cdot 7\text{H}_2\text{O}$																																																										
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																																						
ORTHORHOMBIC	(?)	α :	β :	γ :																																																						
Z:		D:																																																								
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC																																																							
Brugues, Barcelona, SPAIN			3 mg																																																							
		MAJOR ABSORPTION BANDS (cm⁻¹)																																																								
		<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3590</td> <td>mw</td> </tr> <tr> <td></td> <td>A₃</td> <td>3390</td> <td>sh</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1630</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>1125</td> <td>w</td> </tr> <tr> <td></td> <td>D₁</td> <td>1022</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>960</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>760</td> <td>w</td> </tr> <tr> <td></td> <td>D₂</td> <td>620</td> <td>sh</td> </tr> <tr> <td>D</td> <td></td> <td>565</td> <td></td> </tr> <tr> <td></td> <td></td> <td>540</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>511</td> <td></td> </tr> <tr> <td></td> <td></td> <td>471</td> <td></td> </tr> <tr> <td></td> <td></td> <td>380</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>317</td> <td>ms</td> </tr> </table>			A	A ₂	3590	mw		A ₃	3390	sh	B	B ₂	1630	m			1125	w		D ₁	1022	sh			960	w			760	w		D ₂	620	sh	D		565				540	ms		D ₃	511				471				380	w		
A	A ₂	3590	mw																																																							
	A ₃	3390	sh																																																							
B	B ₂	1630	m																																																							
		1125	w																																																							
	D ₁	1022	sh																																																							
		960	w																																																							
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	D ₂	620	sh																																																							
D		565																																																								
		540	ms																																																							
	D ₃	511																																																								
		471																																																								
		380	w																																																							
		317	ms																																																							

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α :	β :	γ :
Z:		D:		
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC	
			mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		

MINERAL NAME MIMETITE	SUB GROUP Series PYROMORPHITE	GROUP APATITE	CLASS ARSENATES	SPECTRA NO A147																		
CHEMICAL FORMULA (IDEAL) $Pb_5(AsO_4)_3Cl$		CHEMICAL FORMULA (ACTUAL)																				
CRYSTAL SYSTEM MONOCLINIC (PSEUDO HEXAGONAL)	SPACE GROUP $P2_1/b(14)$	a: 10.24 α:	b: 20.48 $\beta: 120^\circ$	c: 7.45 γ:																		
ORIGIN OF SAMPLE Bilbao Mine, MEXICO		REMARKS		PARTICLE SIZE 4 mg																		
				MAJOR ABSORPTION BANDS (cm^{-1}) <table> <tr><td>D₁</td><td>1000</td><td>w</td></tr> <tr><td></td><td>951</td><td>w</td></tr> <tr><td>D₂</td><td>805</td><td>sh</td></tr> <tr><td></td><td>785</td><td>s</td></tr> <tr><td>D₃</td><td>406</td><td>s</td></tr> <tr><td></td><td>308</td><td>s</td></tr> </table>	D ₁	1000	w		951	w	D ₂	805	sh		785	s	D ₃	406	s		308	s
D ₁	1000	w																				
	951	w																				
D ₂	805	sh																				
	785	s																				
D ₃	406	s																				
	308	s																				

MINERAL NAME VANADINITE	SUB GROUP	GROUP	CLASS VANADATES	SPECTRA NO A134												
CHEMICAL FORMULA (IDEAL) $Pb_5(VO_4)_3Cl$		CHEMICAL FORMULA (ACTUAL)														
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP $P6_3/m(176)$	a: 10.331 α:	b: 7.343 β:	c: 7.343 γ:												
ORIGIN OF SAMPLE Apache Mine, ARIZONA, USA		REMARKS		PARTICLE SIZE 5 mg												
				MAJOR ABSORPTION BANDS (cm^{-1}) <table> <tr><td>D₂</td><td>799</td><td>s</td></tr> <tr><td></td><td>730</td><td>s</td></tr> <tr><td>D₃</td><td>361</td><td>mw</td></tr> <tr><td></td><td>307</td><td>m</td></tr> </table>	D ₂	799	s		730	s	D ₃	361	mw		307	m
D ₂	799	s														
	730	s														
D ₃	361	mw														
	307	m														

MINERAL NAME ADAMITE	SUB GROUP ADAMITE- OLIVENITE SERIES	GROUP	CLASS ARSENATES	SPECTRA NO A136																																						
CHEMICAL FORMULA (IDEAL) $Zn_2(AsO_4)(OH)$		CHEMICAL FORMULA (ACTUAL)																																								
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnnm (58)	a: 8.30 α:	b: 8.51 β:	c: 6.04 γ:																																						
		Z: 4	D: 4.462																																							
ORIGIN OF SAMPLE Mapimi Durango, MEXICO	REMARKS	PARTICLE SIZE	CONC 4 mg																																							
		MAJOR ABSORPTION BANDS (cm^{-1})																																								
		<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3555</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>879</td> <td>sh</td> </tr> <tr> <td></td> <td>D₂</td> <td>817</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>797</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>729</td> <td>sh</td> </tr> <tr> <td>D</td> <td></td> <td>527</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>507</td> <td>sh</td> </tr> <tr> <td></td> <td>D₃</td> <td>468</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>378</td> <td></td> </tr> <tr> <td></td> <td></td> <td>310</td> <td></td> </tr> </table>			A	A ₂	3555	m			879	sh		D ₂	817	s			797	sh			729	sh	D		527	ms			507	sh		D ₃	468	s			378			
A	A ₂	3555	m																																							
		879	sh																																							
	D ₂	817	s																																							
		797	sh																																							
		729	sh																																							
D		527	ms																																							
		507	sh																																							
	D ₃	468	s																																							
		378																																								
		310																																								

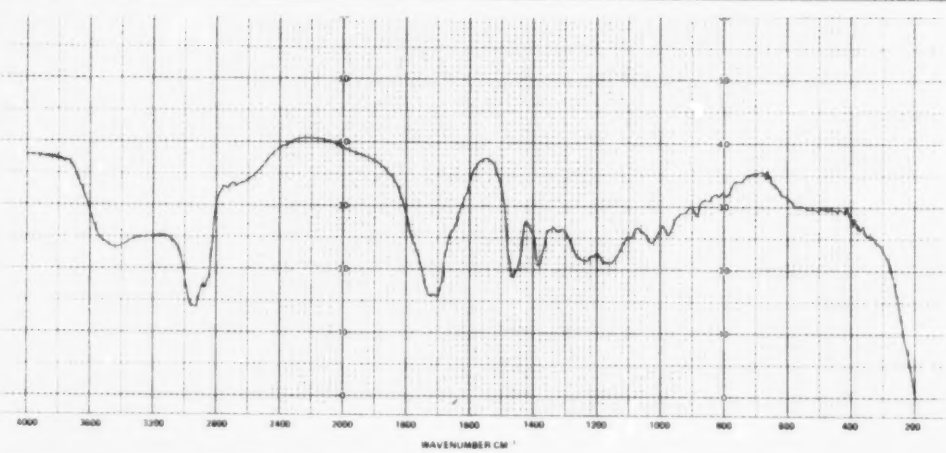
MINERAL NAME OLIVENITE	SUB GROUP ADAMITE- OLIVENITE SERIES	GROUP	CLASS ARSENATES	SPECTRA NO A135																																																						
CHEMICAL FORMULA (IDEAL) $Cu_2(AsO_4)(OH)$		CHEMICAL FORMULA (ACTUAL)																																																								
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnnm (59)	a: 8.22 α:	b: 8.64 β:	c: 5.95 γ:																																																						
		Z: 4	D: 4.45																																																							
ORIGIN OF SAMPLE Myler Mine, NEVADA, USA	REMARKS	PARTICLE SIZE	CONC 4 mg																																																							
		MAJOR ABSORPTION BANDS (cm^{-1})																																																								
		<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3425</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>1080</td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>1031</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>970</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>940</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>850</td> <td>sh</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>821</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>786</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>628</td> <td>w</td> </tr> <tr> <td></td> <td>D₃</td> <td>535</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>487</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>444</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>380</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>338</td> <td>w</td> </tr> </table>			A	A ₂	3425	w			1080	ms		D ₁	1031	m			970	sh			940	mw			850	sh	D	D ₂	821	sh			786	s			628	w		D ₃	535	ms			487	mw			444	w			380	ms		
A	A ₂	3425	w																																																							
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		444	w																																																							
		380	ms																																																							
		338	w																																																							

MINERAL NAME WULFENITE	SUB GROUP	GROUP	CLASS MOLYBDATES	SPECTRA NO A145
CHEMICAL FORMULA (IDEAL) PbMoO₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP I4₁/a (88)	a: 5.435 α:	b: β:	c: 12.11 γ: Z: 4 D: 6.815
ORIGIN OF SAMPLE Arizona, USA	REMARKS		PARTICLE SIZE	CONC. 5 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			D ₂ 840) sh 770) s D ₃ 367) m 350) sh	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α:	β:	γ: Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME SUSSEXITE	SUB GROUP	GROUP KOTOITE- SUSSEXITE	CLASS BORATES	SPECTRA NO A138																										
CHEMICAL FORMULA (IDEAL) MnBO₂(OH)		CHEMICAL FORMULA (ACTUAL)																												
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP (?)	a: 10.70 α:	b: 12.77 β:	c: 3.25 γ:																										
		Z: 8	D: 3.432																											
ORIGIN OF SAMPLE Franklin, Sussex Co., NEW JERSEY, USA	REMARKS		PARTICLE SIZE	CONC 2 mg																										
			MAJOR ABSORPTION BANDS (cm ⁻¹)																											
			<table border="0"> <tr> <td>A₁</td> <td>3697</td> <td>w</td> </tr> <tr> <td rowspan="2">A</td> <td>3568</td> <td rowspan="2">ms</td> </tr> <tr> <td>3520</td> </tr> <tr> <td rowspan="2">B</td> <td>2490</td> <td rowspan="2">mw</td> </tr> <tr> <td>1905</td> </tr> <tr> <td rowspan="2">C</td> <td>1445</td> <td rowspan="2">s</td> </tr> <tr> <td>1362</td> </tr> <tr> <td rowspan="6">D₁</td> <td>1268</td> <td rowspan="2">m</td> </tr> <tr> <td>1220</td> </tr> <tr> <td>995</td> <td rowspan="2">m</td> </tr> <tr> <td>965</td> </tr> <tr> <td>903</td> <td rowspan="2">w</td> </tr> <tr> <td>880</td> </tr> <tr> <td rowspan="2">D</td> <td>825</td> <td rowspan="2">mw</td> </tr> <tr> <td>702</td> </tr> </table>		A ₁	3697	w	A	3568	ms	3520	B	2490	mw	1905	C	1445	s	1362	D ₁	1268	m	1220	995	m	965	903	w	880	D
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	995	m																												
	965																													
	903	w																												
	880																													
D	825	mw																												
	702																													

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO										
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)												
CRYSTAL SYSTEM	SPACE GROUP	a: α:	b: β:	c: γ:										
		Z:	D:											
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg										
			MAJOR ABSORPTION BANDS (cm ⁻¹)											
			<table border="0"> <tr> <td rowspan="6">D₃</td> <td>669</td> <td rowspan="2">mw</td> </tr> <tr> <td>622</td> </tr> <tr> <td>539</td> <td rowspan="2">w</td> </tr> <tr> <td>520</td> </tr> <tr> <td>455</td> <td rowspan="2">sh</td> </tr> <tr> <td>403</td> </tr> <tr> <td>383</td> <td rowspan="2">ms</td> </tr> <tr> <td></td> </tr> </table>		D ₃	669	mw	622	539	w	520	455	sh	403
D ₃	669	mw												
	622													
	539	w												
	520													
	455	sh												
	403													
383	ms													

MINERAL NAME AMBER	SUB GROUP	GROUP	CLASS ORGANIC MINERALS	SPECTRA NO A142
SUCCINITE	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:			
ORIGIN OF SAMPLE Manitoba, CANADA	REMARKS		PARTICLE SIZE	CONC 4 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			A A₂ 3420 ms 2960 s B₁ 2875 sh 2700 sh B 1725 s 1705 s 1468 ms C 1382 m 1240 m D₁ 1161 m 1028 mw D 973 w 883 w D₂ 790 w	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME FORSTERITE	SUB GROUP	GROUP OLIVINE	CLASS NESOSILICATES	SPECTRA NO. A107																					
CHEMICAL FORMULA (IDEAL) Mg₂[SiO₄]		CHEMICAL FORMULA (ACTUAL)																							
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pbnm(62)	a: 4.756 α:	b: 10.195 β:	c: 5.981 γ:																					
		Z: 4	D: 3.271																						
ORIGIN OF SAMPLE EGYPT	REMARKS		PARTICLE SIZE	CONC 2 mg																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																						
			<table> <tr><td>D₁</td><td>980</td><td rowspan="3">sh)</td><td rowspan="3">ms</td></tr> <tr><td></td><td>950</td></tr> <tr><td></td><td>870</td></tr> <tr><td>D₂</td><td>834</td><td rowspan="2">ms</td></tr> <tr><td></td><td>600</td></tr> <tr><td rowspan="5">D₃</td><td>513</td><td rowspan="5">sh)</td><td rowspan="5">ms</td></tr> <tr><td>500</td></tr> <tr><td>465</td><td>w</td></tr> <tr><td>409</td><td>s</td></tr> <tr><td>353</td><td>ms</td></tr> </table>		D ₁	980	sh)	ms		950		870	D ₂	834	ms		600	D ₃	513	sh)	ms	500	465	w	409
D ₁	980	sh)	ms																						
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D ₂	834	ms																							
	600																								
D ₃	513	sh)	ms																						
	500																								
	465			w																					
	409			s																					
	353			ms																					

MINERAL NAME FAYALITE	SUB GROUP	GROUP OLIVINE	CLASS NESOSILICATES	SPECTRA NO. A99																	
CHEMICAL FORMULA (IDEAL) (Fe,Mg)₂[SiO₄]		CHEMICAL FORMULA (ACTUAL)																			
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pbnm(62)	a: 4.799 α:	b: 10.393 β:	c: 6.063 γ:																	
		Z: 4	D: 3.908																		
ORIGIN OF SAMPLE Broken Hill, New S. Wales, AUSTRALIA	REMARKS		PARTICLE SIZE	CONC 2 mg																	
			MAJOR ABSORPTION BANDS (cm⁻¹)																		
			<table> <tr><td rowspan="3">D₁</td><td>950</td><td rowspan="3">sh)</td><td rowspan="3">ms</td></tr> <tr><td>940</td></tr> <tr><td>906</td></tr> <tr><td></td><td>864</td><td rowspan="2">s</td></tr> <tr><td>D₂</td><td>819</td></tr> <tr><td rowspan="4">D₃</td><td>560</td><td rowspan="4">m</td></tr> <tr><td>499</td><td>sh</td></tr> <tr><td>480</td><td>ms</td></tr> <tr><td>339</td><td>ms</td></tr> </table>		D ₁	950	sh)	ms	940	906		864	s	D ₂	819	D ₃	560	m	499	sh	480
D ₁	950	sh)	ms																		
	940																				
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D ₂	819																				
D ₃	560	m																			
	499		sh																		
	480		ms																		
	339		ms																		

MINERAL NAME OLIVINE	SUB GROUP	GROUP OLIVINE	CLASS NESOSILICATES	SPECTRA NO A249																											
CHEMICAL FORMULA (IDEAL) $(\text{Mg,Fe})_2\text{SiO}_4$		CHEMICAL FORMULA (ACTUAL)																													
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pbnm (62)	a: α:	b: β:	c: γ: Z: 4 D: ~3.648 ~3.908																											
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC 1 mg																											
			MAJOR ABSORPTION BANDS (cm⁻¹)																												
			<table> <tr><td>D₁</td><td>980</td><td>ms</td></tr> <tr><td></td><td>950</td><td>w</td></tr> <tr><td></td><td>881</td><td>s</td></tr> <tr><td>D₂</td><td>835</td><td>mw</td></tr> <tr><td></td><td>604</td><td>ms</td></tr> <tr><td></td><td>520</td><td>sh</td></tr> <tr><td></td><td>500</td><td>ms</td></tr> <tr><td>D₃</td><td>465</td><td>w</td></tr> <tr><td></td><td>410</td><td>s</td></tr> <tr><td></td><td>355</td><td>mw</td></tr> </table>		D ₁	980	ms		950	w		881	s	D ₂	835	mw		604	ms		520	sh		500	ms	D ₃	465	w		410	s
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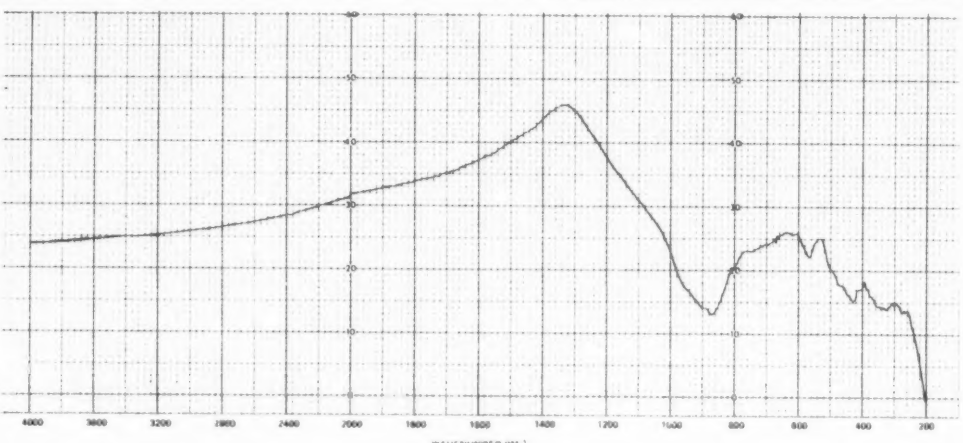
MINERAL NAME ALMANDINE	SUB GROUP PYRALSPITE	GROUP GARNET	CLASS NESOSILICATES	SPECTRA NO A105																								
CHEMICAL FORMULA (IDEAL) $\text{Fe}_3\text{Al}_2[\text{SiO}_4]_3$		CHEMICAL FORMULA (ACTUAL)																										
CRYSTAL SYSTEM CUBIC	SPACE GROUP Ia3d ()	a: 11.526 α:	b: β:	c: γ: Z: 8 D: 4.313																								
ORIGIN OF SAMPLE Wrangell, Alaska, USA	REMARKS		PARTICLE SIZE	CONC 2 mg																								
			MAJOR ABSORPTION BANDS (cm⁻¹)																									
			<table> <tr><td></td><td>980</td><td>sh</td></tr> <tr><td>D₁</td><td>954</td><td>s</td></tr> <tr><td></td><td>890</td><td>s</td></tr> <tr><td>D₂</td><td>866</td><td></td></tr> <tr><td></td><td>627</td><td>sh</td></tr> <tr><td></td><td>560</td><td>ms</td></tr> <tr><td></td><td>469</td><td></td></tr> <tr><td>D₃</td><td>445</td><td>s</td></tr> <tr><td></td><td>370</td><td>ms</td></tr> </table>			980	sh	D ₁	954	s		890	s	D ₂	866			627	sh		560	ms		469		D ₃	445	s
	980	sh																										
D ₁	954	s																										
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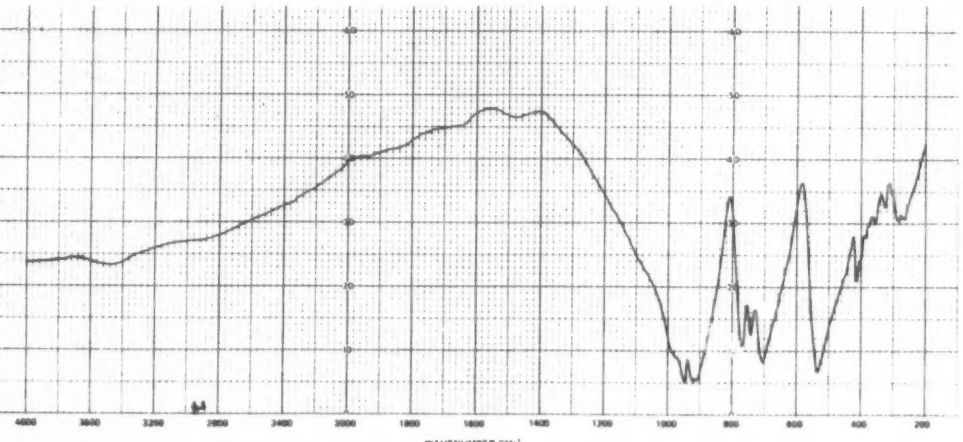
MINERAL NAME ANDRADITE	SUB GROUP GRANDITE	GROUP GARNET	CLASS NESOSILICATES	SPECTRA NO A96
CHEMICAL FORMULA (IDEAL) $\text{Ca}_3\text{Fe}_2(\text{SiO}_4)_3$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP Ia3d (230)	a: 12.059 α:	b: β:	c: γ:
		Z: 8	D: 3.849	
ORIGIN OF SAMPLE Stanley, Graham Co. Arizona, USA	REMARKS		PARTICLE SIZE	CONC 3 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			D₁ 920 sh) --- 885 s D₂ 828) s 809 D 585 mw 507 s 474 ms 431 s D₃ 377 s 341 ms 300 ms	

MINERAL NAME GROSSULAR	SUB GROUP GRANDITE	GROUP GARNET	CLASS NESOSILICATES	SPECTRA NO A105
CHEMICAL FORMULA (IDEAL) $\text{Ca}_3\text{Al}_2(\text{SiO}_4)_3$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP Ia3d (230)	a: 11.851 α:	b: β:	c: γ:
		Z: 8	D: 3.6	
ORIGIN OF SAMPLE Asbestos, Quebec, CANADA	REMARKS		PARTICLE SIZE	CONC 2 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			D₁ 948 sh) m 913 s D₂ 860) s 840) m 618 D 542 ms D₃ 472 sh) s 447 s 389 s	

MINERAL NAME PYROPE	SUB GROUP PYRALSPITE	GROUP GARNET	CLASS NESOSILICATES	SPECTRA NO A100
CHEMICAL FORMULA (IDEAL) Mg₃Al₂(SiO₄)₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM CUBIC	SPACE GROUP Ia3d (230)	a: 11.455 α:	b: β:	c: γ:
ORIGIN OF SAMPLE Navajo, N. Arizona, U.S.A.		REMARKS		PARTICLE SIZE 2 mg
				MAJOR ABSORPTION BANDS (cm⁻¹) D ₁ 993 sh) s 964) D ₂ 896) s 868) D 571 526 sh) mw 478) D ₃ 455) s 382) mw 331) w

MINERAL NAME ZIRCON	SUB GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO A259
CHEMICAL FORMULA (IDEAL) ZrSiO₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP I4₁/amd (141)	a: 6.604 α:	b: β:	c: 5.979 γ:
ORIGIN OF SAMPLE GSC 65		REMARKS		PARTICLE SIZE 2mg
				MAJOR ABSORPTION BANDS (cm⁻¹) D ₁ 994 sh) s 868) D ₂ 606) mw 428) w D 381) w

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
TITANITE		TITANITE	NESOSILICATES	A103
SPHENE	CHEMICAL FORMULA (IDEAL) CaTi[SiO ₄](O,OH,F) or CaTiSiO ₅		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/c (15)	a: 6.549 α:	b: 8.682 β: 119°49'	c: 7.435 γ: Z: 4 D: 3.53
ORIGIN OF SAMPLE GSC 49	REMARKS			PARTICLE SIZE CONC 2 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				D ₂ 867 ms 561 m D ₃ 424 ms

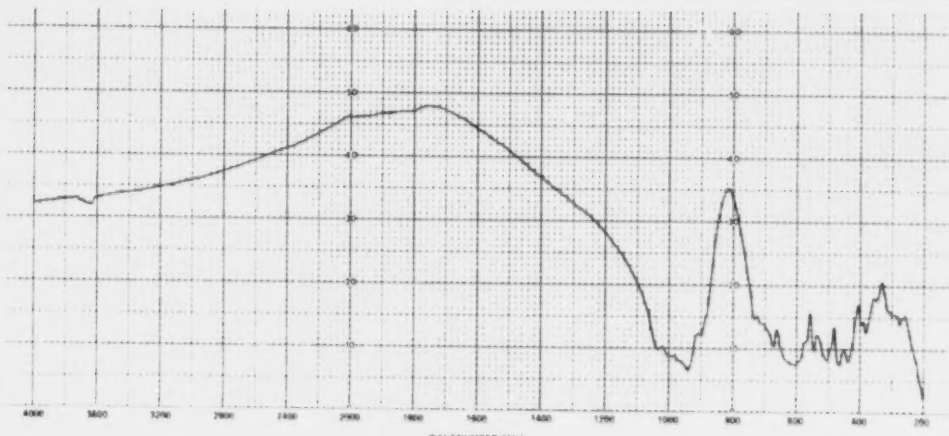
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
HELVITE		HELVITE	NESOSILICATES	A295
	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)	
	Mn ₄ Be ₃ (SiO ₄) ₃ S			
CRYSTAL SYSTEM	SPACE GROUP	a: 8.297	b:	c:
CUBIC	()	α:	β:	γ:
			Z: 2	D:
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
GSC 15175				CONC
				2 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				974 sh)
				947
				D ₁ 920)
				908)
				D ₂ 767
				740
				701
				531
				D ₃ 410
				354
				322

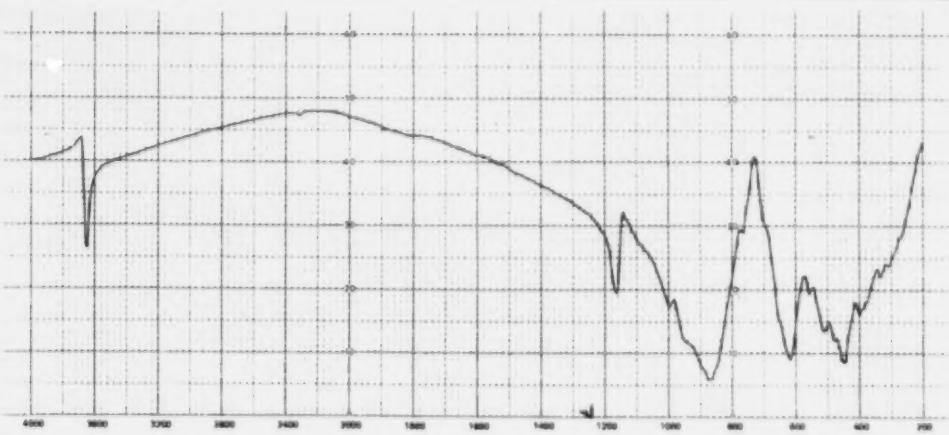
MINERAL NAME DATOLITE	SUB GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO A58																																														
CHEMICAL FORMULA (IDEAL) $\text{CaB}[\text{SiO}_4](\text{OH})$		CHEMICAL FORMULA (ACTUAL)																																																
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $P2_1/a$ (14)	a: 9.62 α :	b: 7.60 β : $90^\circ 09'$	c: 4.84 γ : 4 Z: 4 D: 3.05																																														
ORIGIN OF SAMPLE Connecticut, U.S.A.	REMARKS	PARTICLE SIZE	CONC. 2mg																																															
		MAJOR ABSORPTION BANDS (cm^{-1})																																																
		<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3500</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1152</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1095</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1037</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>1003</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>986</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>941</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>914</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>879</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>847</td> <td>s</td> </tr> <tr> <td></td> <td>D₂</td> <td>781</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>684</td> <td>ms</td> </tr> </table>			A	A ₂	3500	s			1152	s			1095	s			1037	s		D ₁	1003	s			986	s			941	s			914	s			879	s			847	s		D ₂	781	s		
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MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																						
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																								
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																						
	()	α :	β :	γ :																						
Z:	D:																									
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC. mg																							
		MAJOR ABSORPTION BANDS (cm^{-1})																								
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MINERAL NAME SILLIMANITE	SUB GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO A241																															
CHEMICAL FORMULA (IDEAL) Al_2SiO_5		CHEMICAL FORMULA (ACTUAL)																																	
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pbnm (62)	a: 7.4856 α:	b: 7.6738 β:	c: 5.7698 γ:																															
		Z: 4		D: 3.347																															
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC 1 mg																															
			MAJOR ABSORPTION BANDS (cm^{-1})																																
			<table border="0"> <tr><td></td><td>1179</td><td>S</td></tr> <tr><td rowspan="3">D₁</td><td>1074</td><td>W</td></tr> <tr><td>958</td><td>MS</td></tr> <tr><td>895</td><td>S</td></tr> <tr><td></td><td>817</td><td>S</td></tr> <tr><td rowspan="3">D₂</td><td>742</td><td>MS</td></tr> <tr><td>685</td><td>S</td></tr> <tr><td>629</td><td>M</td></tr> <tr><td rowspan="3">D</td><td>541</td><td>sh W</td></tr> <tr><td>508</td><td>S</td></tr> <tr><td>483</td><td>WS</td></tr> <tr><td rowspan="3">D₃</td><td>443</td><td>M</td></tr> <tr><td>367</td><td>MW</td></tr> <tr><td>313</td><td>W</td></tr> </table>			1179	S	D ₁	1074	W	958	MS	895	S		817	S	D ₂	742	MS	685	S	629	M	D	541	sh W	508	S	483	WS	D ₃	443	M	367
	1179	S																																	
D ₁	1074	W																																	
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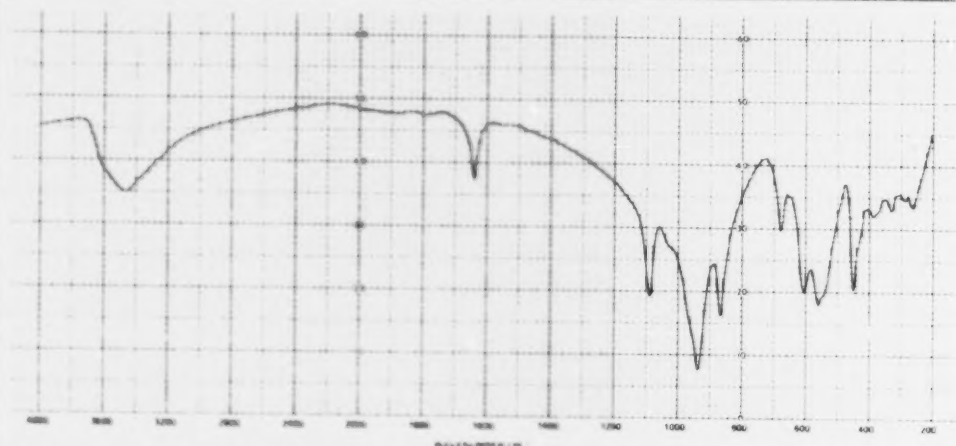
MINERAL NAME ANDALUSITE	SUB GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO A109																												
CHEMICAL FORMULA (IDEAL) $Al_2O(SiO_4)$ or Al_2SiO_5		CHEMICAL FORMULA (ACTUAL)																														
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnnm (58)	a: 7.7942 α:	b: 7.8985 β:	c: 5.5590 γ:																												
		Z: 4		D: 3.144																												
ORIGIN OF SAMPLE Teshirogi, Fukushima, JAPAN	REMARKS		PARTICLE SIZE	CONC 2 mg																												
			MAJOR ABSORPTION BANDS (cm^{-1})																													
			<table border="0"> <tr><td></td><td>969</td><td>W</td></tr> <tr><td rowspan="3">D₁</td><td>930</td><td>S</td></tr> <tr><td>895</td><td>WS</td></tr> <tr><td>775</td><td>M</td></tr> <tr><td rowspan="4">D₂</td><td>735</td><td>M</td></tr> <tr><td>675</td><td>MS</td></tr> <tr><td>600</td><td>S</td></tr> <tr><td>520</td><td>MS</td></tr> <tr><td rowspan="4">D₃</td><td>480</td><td>M</td></tr> <tr><td>450</td><td>S</td></tr> <tr><td>440</td><td>sh M</td></tr> <tr><td>383</td><td>MW</td></tr> <tr><td></td><td>347</td><td>MW</td></tr> </table>			969	W	D ₁	930	S	895	WS	775	M	D ₂	735	M	675	MS	600	S	520	MS	D ₃	480	M	450	S	440	sh M	383	MW
	969	W																														
D ₁	930	S																														
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	775	M																														
D ₂	735	M																														
	675	MS																														
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D ₃	480	M																														
	450	S																														
	440	sh M																														
	383	MW																														
	347	MW																														

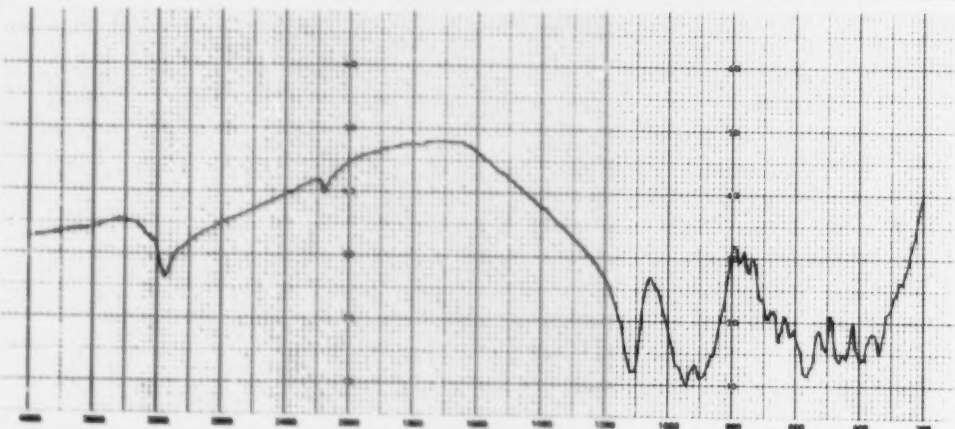
MINERAL NAME KYANITE	SUB GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO A104																								
CHEMICAL FORMULA (IDEAL) Al ₂ O(SiO ₄) or Al ₂ SiO ₅		CHEMICAL FORMULA (ACTUAL)																										
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P $\bar{1}$ (2)	a: 7.1192 b: 7.8473 c: 5.5724 Z: 4 α : 90°01' β : 101°07' γ : 74°00' D: 3.67																										
ORIGIN OF SAMPLE GSC 59	REMARKS		PARTICLE SIZE	CONC. 2 mg																								
			MAJOR ABSORPTION BANDS (cm ⁻¹)																									
			<table><tr><td rowspan="3">D₁</td><td>1029</td><td>S</td></tr><tr><td>985</td><td>S</td></tr><tr><td>936</td><td>S</td></tr><tr><td rowspan="3">D₂</td><td>895</td><td>S</td></tr><tr><td>666</td><td>S</td></tr><tr><td>600</td><td>S</td></tr><tr><td rowspan="6">D₃</td><td>541</td><td>S</td></tr><tr><td>500</td><td>S</td></tr><tr><td>463</td><td>S</td></tr><tr><td>433</td><td>S</td></tr><tr><td>391</td><td>ms</td></tr><tr><td>379</td><td>S</td></tr></table>		D ₁	1029	S	985	S	936	S	D ₂	895	S	666	S	600	S	D ₃	541	S	500	S	463	S	433	S	391
D ₁	1029	S																										
	985	S																										
	936	S																										
D ₂	895	S																										
	666	S																										
	600	S																										
D ₃	541	S																										
	500	S																										
	463	S																										
	433	S																										
	391	ms																										
	379	S																										

MINERAL NAME TOPAZ	SUB GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO A255
CHEMICAL FORMULA (IDEAL) Al ₂ SiO ₄ (F,OH) ₂		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pmnb (62)	a: 8.394 α:	b: 8.791 β:	c: 4.648 γ: Z: 4 D: 3.558
ORIGIN OF SAMPLE SOUTH AMERICA	REMARKS		PARTICLE SIZE	CONC 1.5mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			A A ₁ 3648 ms	
			1161 m	
			D ₁ 992 sh) w	
			868 s	
			D ₂ 762 sh w	
			613 s	
			551 w	
			506 w	
			D ₃ 475 w	
			445 s	
			396 mw	

MINERAL NAME STAUROLITE	SUB-GROUP	GROUP	CLASS NESOSILICATES	SPECTRA NO. A95																		
CHEMICAL FORMULA (IDEAL) $(\text{Fe}^{2+}, \text{Mg})_2(\text{Al}, \text{Fe}^{3+})_9\text{O}_6(\text{SiO}_4)_4(\text{O}, \text{OH})_2$		CHEMICAL FORMULA (ACTUAL)																				
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Ccmm 63 1	a: 7.82 α :	b: 16.52 β :	c: 5.63 γ : Z: 4 D: 3.75																		
ORIGIN OF SAMPLE Gourin Morbihan, FRANCE	REMARKS	PARTICLE SIZE	CONC. 3mg																			
		MAJOR ABSORPTION BANDS (cm ⁻¹)																				
		<table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3410</td> <td>m</td> </tr> <tr> <td rowspan="5">D</td> <td rowspan="5">D₁</td> <td>1076</td> <td>S</td> </tr> <tr> <td>1011</td> <td>S</td> </tr> <tr> <td>469</td> <td>S</td> </tr> <tr> <td>426</td> <td>S</td> </tr> <tr> <td>390</td> <td>S</td> </tr> <tr> <td></td> <td>D₃</td> <td>362</td> <td>S</td> </tr> </table>			A	A ₂	3410	m	D	D ₁	1076	S	1011	S	469	S	426	S	390	S		D ₃
A	A ₂	3410	m																			
D	D ₁	1076	S																			
		1011	S																			
		469	S																			
		426	S																			
		390	S																			
	D ₃	362	S																			

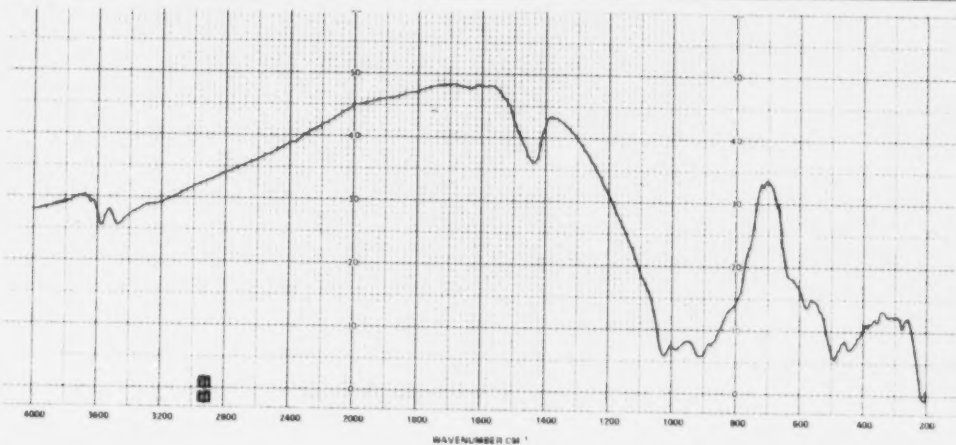
MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO.
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC. mg	
		MAJOR ABSORPTION BANDS (cm ⁻¹)		

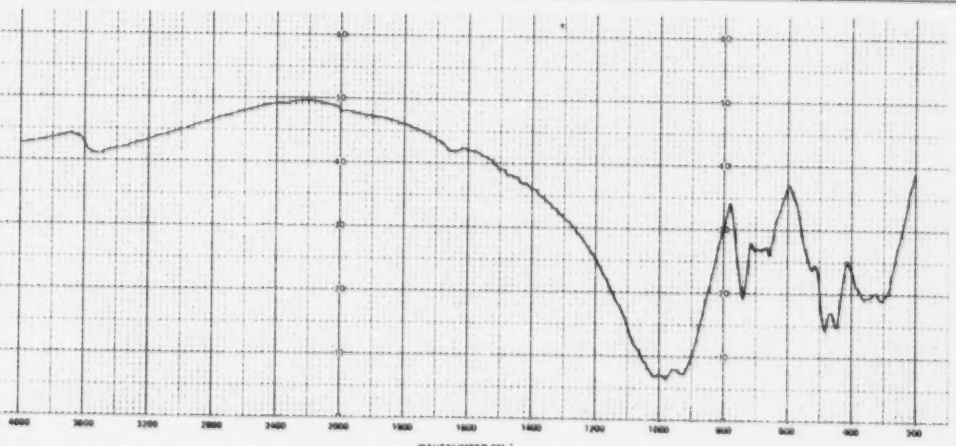
MINERAL NAME HEMIMORPHITE	SUB GROUP	GROUP	CLASS SOROSILICATES	SPECTRA NO A74
CHEMICAL FORMULA (IDEAL) $Zn_4(Si_2O_7)(OH)_2 \cdot H_2O$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Imm2 (44)	a: 8.370 α:	b: 10.719 β:	c: 5.120 γ: Z: 2 D: 3.366
ORIGIN OF SAMPLE Mapimi In Durango, MEXICO	REMARKS			PARTICLE SIZE CONC 2 mg
				MAJOR ABSORPTION BANDS (cm⁻¹)
				A A ₂ 3460 ms
				B B ₂ 1640 ms
				D ₁ 1090 ms
				935 s
				860 ms
				D ₂ 675 m
				600 ms
				555)
				540 ms
				D ₃ 450 ms
				381 w
				324 w

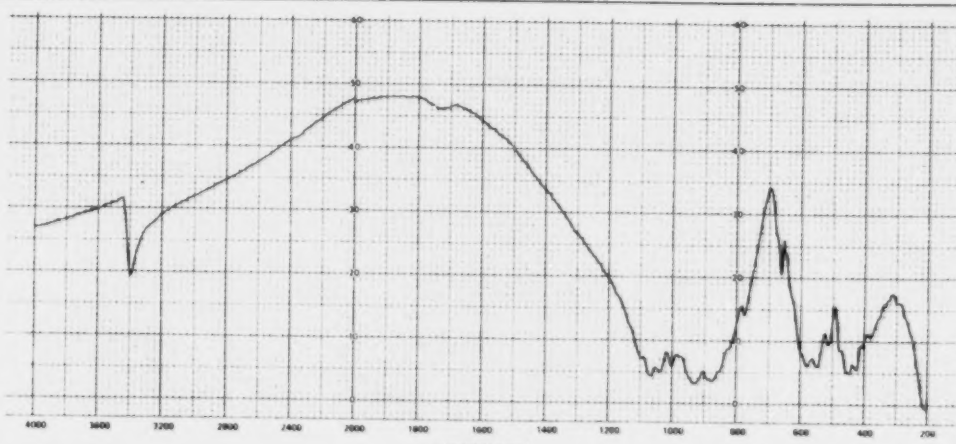
MINERAL NAME ZOISITE	SUB GROUP	GROUP EPIDOTES	CLASS SOROSILICATES	SPECTRA NO A69
CHEMICAL FORMULA (IDEAL) Ca ₂ Al ₃ (Si ₃ O ₁₂)(OH)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pbnm (62)	a: 10.16 α:	b: 16.23 β:	c: 5.51 γ: Z: 4 D: 3.33
ORIGIN OF SAMPLE MADAGASCAR	REMARKS			PARTICLE SIZE CONC 2 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				A A ₄ 3158 m
				1104
				D ₁ 943 s
				898
				773 w
				D ₂ 747 w
				649 mw
				D 613 w
				567 s
				507 m
				D ₃ 463 ms
				439
				395 ms

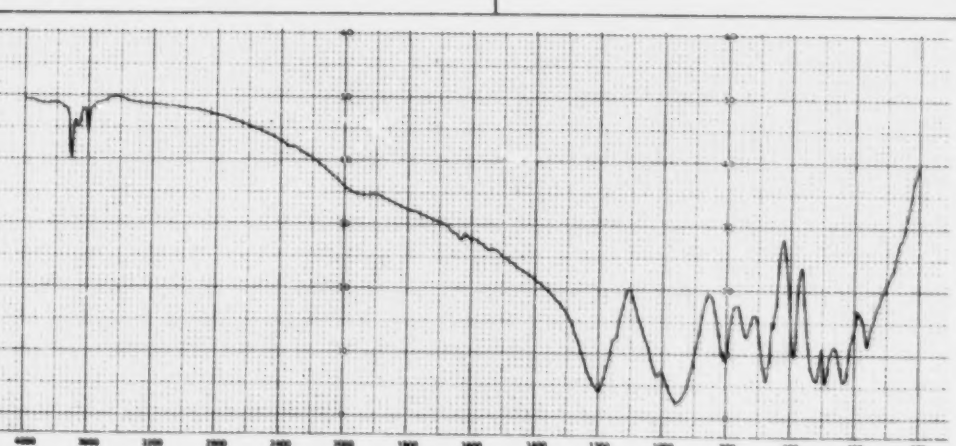
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																					
EPIDOTE		EPIDOTES	SOROSILICATES	A70																																																					
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																							
$\text{Ca}_2(\text{Al}, \text{Fe})_3(\text{Si}_3\text{O}_{12})(\text{OH})$																																																									
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																																					
MONOCLINIC	$\text{P2}_1/\text{m} (11)$	10.25	5.63	8.91																																																					
		$\alpha:$	$\beta: 115^\circ 24'$	$\gamma:$																																																					
		Z: 2		D: 3.46																																																					
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																																					
Nakatsugawa, Gifu, JAPAN				2mg																																																					
			MAJOR ABSORPTION BANDS (cm^{-1})																																																						
			<table border="0"> <tr> <td>A</td> <td>A₃</td> <td>3370</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>1170</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>1074</td> <td>mw</td> </tr> <tr> <td>D₁</td> <td></td> <td>1033</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>947</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>877</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>832 sh</td> <td></td> </tr> <tr> <td>D₂</td> <td></td> <td>715 sh</td> <td></td> </tr> <tr> <td></td> <td></td> <td>648</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>560 sh</td> <td></td> </tr> <tr> <td></td> <td></td> <td>515</td> <td>ms</td> </tr> <tr> <td>D₃</td> <td></td> <td>445</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>393</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>347</td> <td></td> </tr> </table>		A	A ₃	3370	mw			1170	mw			1074	mw	D ₁		1033	mw			947	s			877	ms			832 sh		D ₂		715 sh				648	s			560 sh				515	ms	D ₃		445	mw			393	mw	
A	A ₃	3370	mw																																																						
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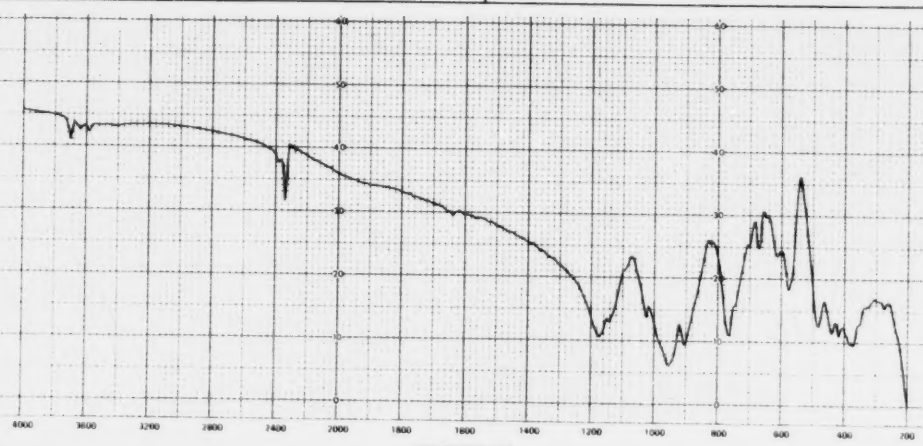
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
SERANDITE		PECTOLITE	ORTHOSILICATES	A101
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
Na(Mn ⁺² ,Ca) ₂ (Si ₃ O ₈)(OH)				
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
TRICLINIC	P1̄ ()	α:	β:	γ:
Z:		D: 3.32		
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC	
Mont. Ste. Hilaire, Quebec, CANADA			2 mg	
		MAJOR ABSORPTION BANDS (cm ⁻¹)		
		1042 s D ₁ 908 s 665 sh) D ₂ 648) ms 527 m 470 sh) D ₃ 439 s 345 w		

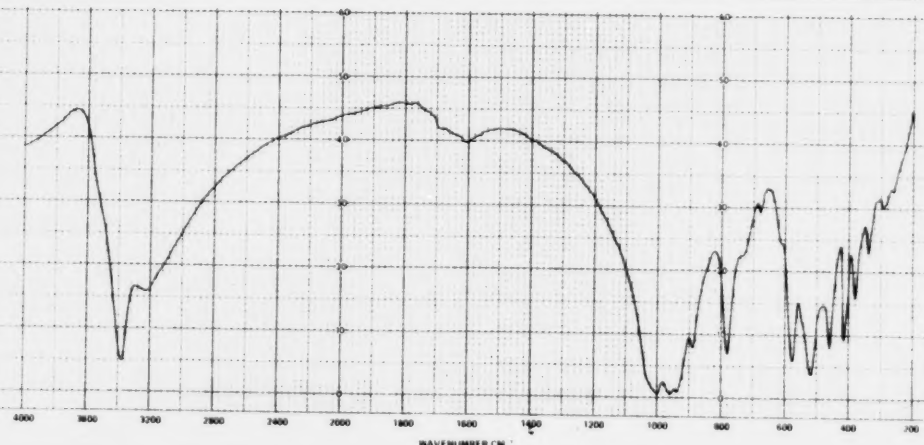
MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO		
VESUVIANITE			SOROSILICATES	A248		
IDOCRASE	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)			
	$\text{Ca}_{10}\text{Mg}_2\text{Al}_4(\text{SiO}_4)_5(\text{Si}_2\text{O}_7)_2(\text{OH})_4$					
CRYSTAL SYSTEM	SPACE GROUP	a: 15.63 α:	b: β:	c: 11.83 γ:		
TETRAGONAL	P4/nnc(126)			Z: 4 D: 3.34		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
GSC Sample				2 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₁	3575	mw
					3465	mw
					1021	
				D ₁	982	s
					905	
				D ₂	872	s
			D		580	ms
				D ₃	490	s
					442	

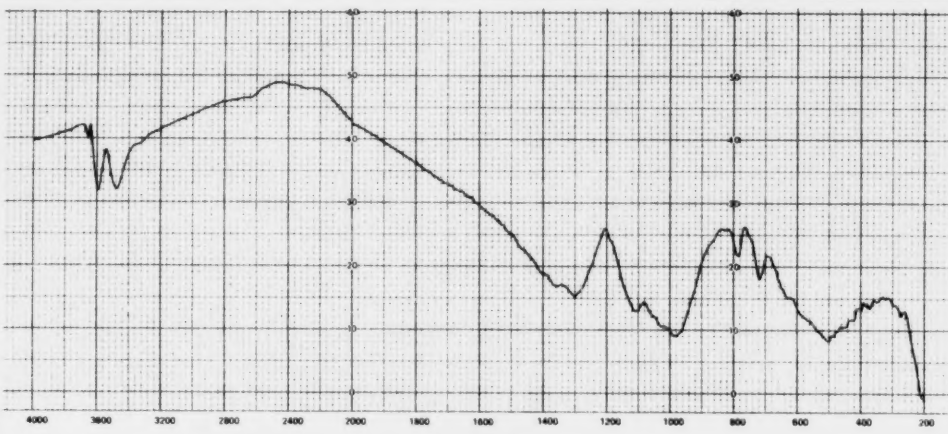
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
EUDIALYTE		CATAPLEIITE- EUDIALYTE	CYCLOSILICATES	A67
	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)	
	$\text{Na}_4(\text{Ca,Ce,Fe})_2\text{Zr}[\text{Si}_6\text{O}_{17}](\text{OH,Cl})_2$			
CRYSTAL SYSTEM	SPACE GROUP			
TRIGONAL	$\bar{R}3_m$ (166)			
	a: 14.31	b:	c: 30.15	Z: 12
	α :	β :	γ :	D: 2.87
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
Mont. Ste. Hilaire, Quebec, CANADA				CONC
				2 mg
				MAJOR ABSORPTION BANDS (cm^{-1})
				A A ₂ 3525 w
				1009
				D ₁ 990) s
				992
				736 ms
				D ₂ 675 br m
				D 520 w
				480
				D ₃ 443) ms
				357
				300) m

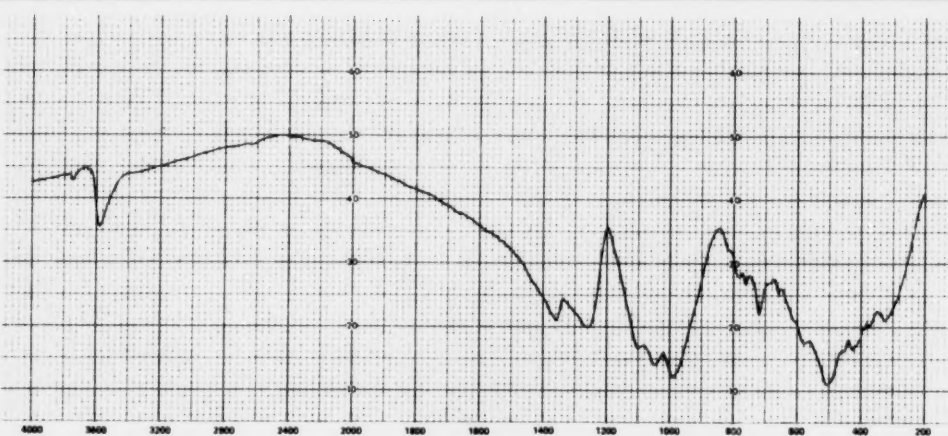
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																					
AXINITE		AXINITE-DANBURITE	?	A65																																																					
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																							
$\text{Ca}_2\text{Fe}^{2+}\text{Al}_2\text{B}[\text{Si}_4\text{O}_{15}](\text{OH})$																																																									
CRYSTAL SYSTEM	SPACE GROUP																																																								
TRICLINIC	$P\bar{1} (2)$	a: 8.960 $\alpha: 102^\circ 18'$	b: 9.156 $\beta: 98^\circ 24'$	c: 7.148 $\gamma: 88^\circ 04'$																																																					
		Z: 2		D: 3.31																																																					
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC																																																						
Unknown			2 mg																																																						
		MAJOR ABSORPTION BANDS (cm^{-1})																																																							
		<table><tr><td>A</td><td>A</td><td>3392</td><td>ms</td></tr><tr><td rowspan="4">D₁</td><td></td><td>1094</td><td>s</td></tr><tr><td></td><td>1066</td><td>s</td></tr><tr><td></td><td>1036</td><td>mw</td></tr><tr><td></td><td>1001</td><td>s</td></tr><tr><td rowspan="4">D₂</td><td></td><td>924</td><td>s</td></tr><tr><td></td><td>870</td><td>s</td></tr><tr><td></td><td>773</td><td>ms</td></tr><tr><td></td><td>659</td><td>ms</td></tr><tr><td rowspan="8">D₃</td><td></td><td>574</td><td>s</td></tr><tr><td></td><td>544</td><td>ms</td></tr><tr><td></td><td>510</td><td>mw</td></tr><tr><td></td><td>472</td><td>sh</td></tr><tr><td></td><td>446</td><td>s</td></tr><tr><td></td><td>412</td><td>sh</td></tr><tr><td></td><td>404</td><td>sh</td></tr><tr><td></td><td>378</td><td>sh</td></tr></table>			A	A	3392	ms	D ₁		1094	s		1066	s		1036	mw		1001	s	D ₂		924	s		870	s		773	ms		659	ms	D ₃		574	s		544	ms		510	mw		472	sh		446	s		412	sh		404	sh	
A	A	3392	ms																																																						
D ₁		1094	s																																																						
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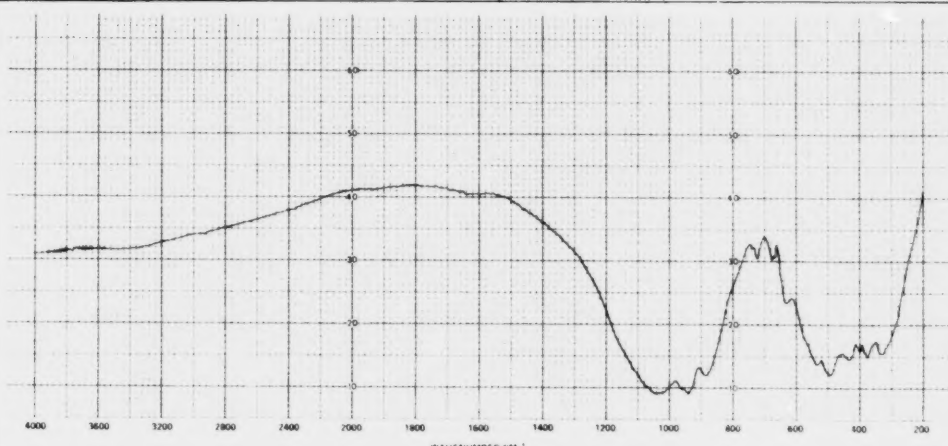
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																						
BERYL		BERYL	CYCLOSILICATES	A72																						
CHEMICAL FORMULA (IDEAL): $\text{Be}_3\text{Al}_2[\text{Si}_6\text{O}_{18}]$		CHEMICAL FORMULA (ACTUAL):																								
CRYSTAL SYSTEM	SPACE GROUP	a: 9.21 α :	b: β :	c: 9.17 γ :																						
HEXAGONAL	P6/mcc (192)		Z: 2	D: 2.640																						
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC																							
Naegi, Gifu, JAPAN			2 mg																							
			MAJOR ABSORPTION BANDS (cm^{-1})																							
			<table><tr><td rowspan="3">D₁</td><td>1198</td><td>s</td></tr><tr><td>1017</td><td>sh</td></tr><tr><td>953</td><td>s</td></tr><tr><td rowspan="3">D₂</td><td>804</td><td>ms</td></tr><tr><td>738</td><td>m</td></tr><tr><td>676</td><td>s</td></tr><tr><td rowspan="5">D₃</td><td>589</td><td>s</td></tr><tr><td>519</td><td>s</td></tr><tr><td>491</td><td>ms</td></tr><tr><td>432</td><td>s</td></tr><tr><td>359</td><td>ms</td></tr></table>		D ₁	1198	s	1017	sh	953	s	D ₂	804	ms	738	m	676	s	D ₃	589	s	519	s	491	ms	432
D ₁	1198	s																								
	1017	sh																								
	953	s																								
D ₂	804	ms																								
	738	m																								
	676	s																								
D ₃	589	s																								
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	432	s																								
	359	ms																								

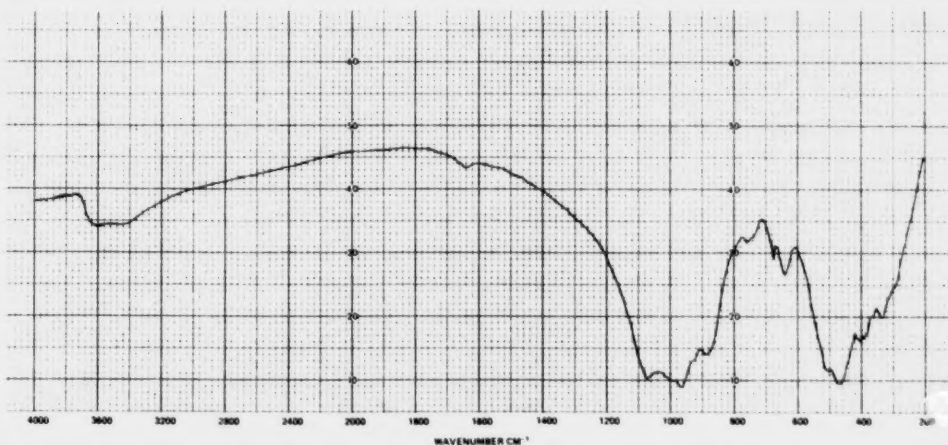
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CORDIERITE		BERYL	CYCLOSILICATES	A66
CHEMICAL FORMULA (IDEAL) $Mg_2Al_4Si_5O_{18}$ OR $Mg_2Al_3[Si_5AlO_{18}]$			CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP	a: 9.738 α :	b: 17.083 β :	c: 9.335 γ :
ORTHORHOMBIC	Cccm(66)		Z: 4	D: 2.499
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
Tsihombe, MADAGASCAR				CONC
				3 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				1171) ms
				1138) sh
				D ₁ 1023 mw
				949 s
				902 m
				763) ms
				D 743)
				D ₂ 698
				669 mw
				610) ms
				573)
				D ₃ 480 ms
				438)
				416) s
				370)

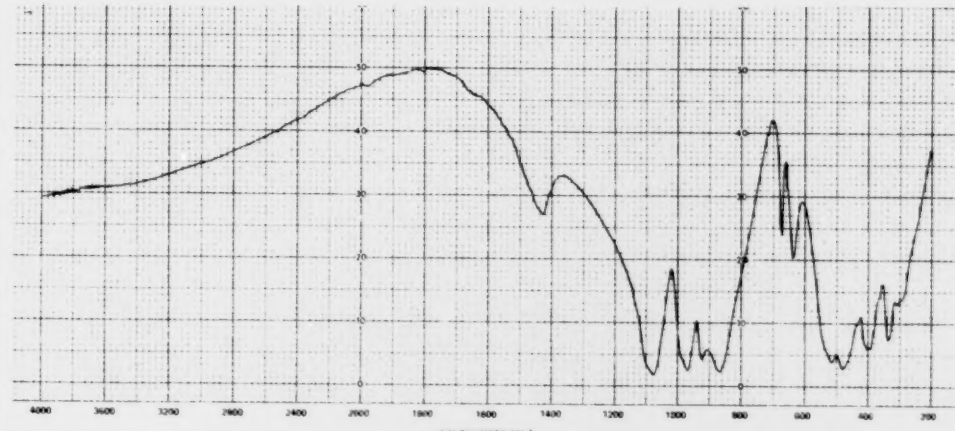
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																								
DIOPTASE		DIOPTASE	CYCLOSILICATES	A68																																																								
	CHEMICAL FORMULA (IDEAL) Cu[SiO ₂](OH) ₂		CHEMICAL FORMULA (ACTUAL)																																																									
CRYSTAL SYSTEM	SPACE GROUP	a: 14.61 α:	b: β:	c: 7.80 γ:																																																								
TRIGONAL	R $\bar{3}$ (148)		Z: 3	D: 3.27																																																								
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																																								
Tsumeb, S-W AFRICA				CONC. 2 mg																																																								
				MAJOR ABSORPTION BANDS (cm ⁻¹)																																																								
				<table><tr><td>A</td><td>A₃</td><td>3380</td><td>s</td></tr><tr><td></td><td></td><td>3220</td><td>ms</td></tr><tr><td>B</td><td>B₂</td><td>1600</td><td>mw</td></tr><tr><td></td><td></td><td>995</td><td></td></tr><tr><td></td><td>D₁</td><td>960</td><td>s</td></tr><tr><td></td><td></td><td>935</td><td></td></tr><tr><td></td><td></td><td>885</td><td></td></tr><tr><td></td><td>D₂</td><td>780</td><td>s</td></tr><tr><td></td><td></td><td>680</td><td>w</td></tr><tr><td>D</td><td></td><td>575</td><td>s</td></tr><tr><td></td><td></td><td>515</td><td>s</td></tr><tr><td></td><td>D₃</td><td>460</td><td>m</td></tr><tr><td></td><td></td><td>415</td><td>ms</td></tr><tr><td></td><td></td><td>380</td><td>m</td></tr><tr><td></td><td></td><td>340</td><td>mw</td></tr></table>	A	A ₃	3380	s			3220	ms	B	B ₂	1600	mw			995			D ₁	960	s			935				885			D ₂	780	s			680	w	D		575	s			515	s		D ₃	460	m			415	ms			380	m
A	A ₃	3380	s																																																									
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	D ₁	960	s																																																									
		935																																																										
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	D ₂	780	s																																																									
		680	w																																																									
D		575	s																																																									
		515	s																																																									
	D ₃	460	m																																																									
		415	ms																																																									
		380	m																																																									
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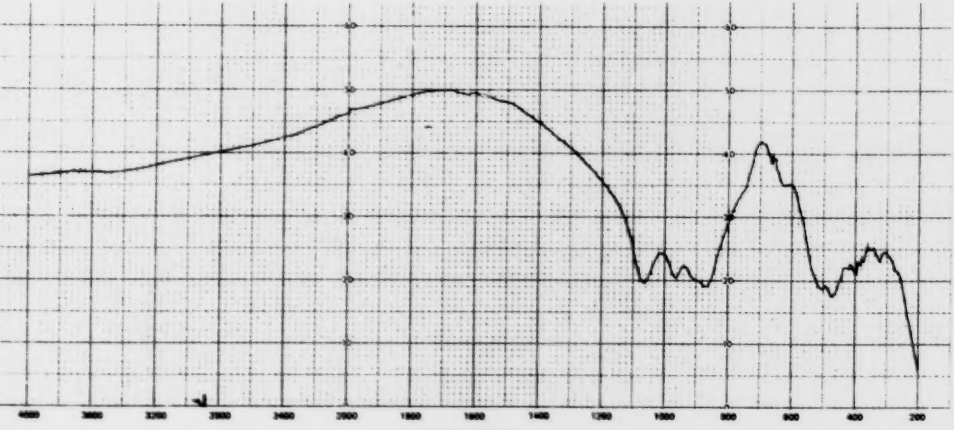
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO				
ELBAITE		TOURMALINE	CYCLOSILICATES	A63				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)						
Na(Li,Al) ₃ Al ₆ (BO ₃) ₃ [Si ₆ O ₁₈](OH) ₄								
CRYSTAL SYSTEM	SPACE GROUP	a: 15.843 α:	b: β:	c: 7.102 γ:	Z: 3	D: 3.021		
TRIGONAL	R3m(160)							
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC		
San Diego, CALIFORNIA, USA						3 mg		
					MAJOR ABSORPTION BANDS (cm ⁻¹)			
					A	A ₁	3657	w
							3590	mw
						A ₂	3475	mw
						1104		ms
D	D ₁	979	s					
		781	mw					
	D ₂	714	mw					
	D ₃	505	s					

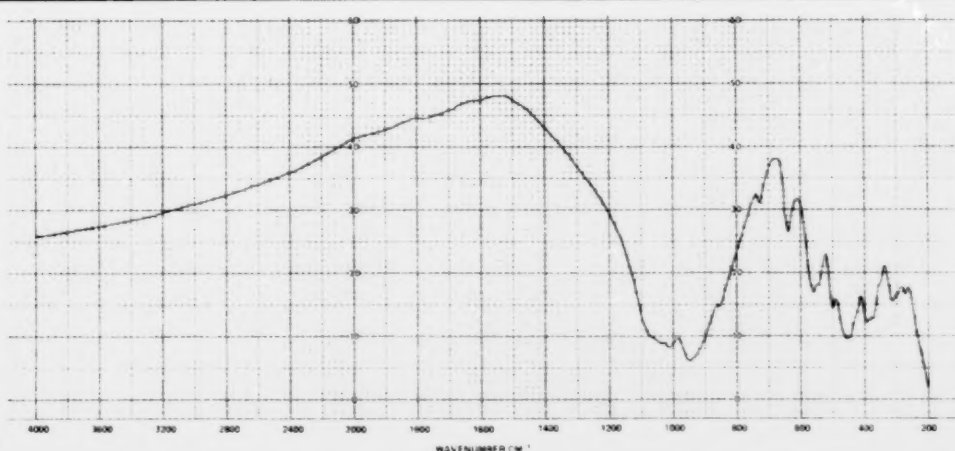
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO				
DRAVITE		TOURMALINE	CYCLOSILICATES	A71				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)						
NaMg ₃ Al ₆ (BO ₃) ₃ [Si ₆ O ₁₈](OH) ₄								
CRYSTAL SYSTEM	SPACE GROUP	a: 15.931 α:	b: β:	c: 7.197 γ:	Z: 3	D: 3.019		
TRIGONAL	R3m (160)							
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC		
Yinnietharra Station, WESTERN AUSTRALIA						2 mg		
					MAJOR ABSORPTION BANDS (cm ⁻¹)			
					A	A ₁	3745	w
							3685	m
					C		1351	ms
							1253	ms
							1093	mw
					D ₁		1039	mw
							990	s
							775	w
					D ₂		754	w
		720	m					
		499	s					
D ₃		417	w					
		319	w					

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
HYPERSTHENE	ENSTATITE -ORTHO FERROSILITE	ORTHO-PYROXENE	INOSILICATES	A123			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
OR (Mg,Fe)[SiO ₃]							
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:	Z:	D:	
ORTHORHOMBIC	Pbca (61)	18.325 α:	8.918 β:	5.216 γ:	8	3.650	
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE	CONC		
Klamath Co., OREGON, USA					2 mg		
					MAJOR ABSORPTION BANDS (cm ⁻¹)		
					D ₁	1030	S
						940	S
						883	S
					D ₂	720	mw
						627	m
						530	ms
					D ₃	494	S
						429	ms
						379	ms
						327	ms

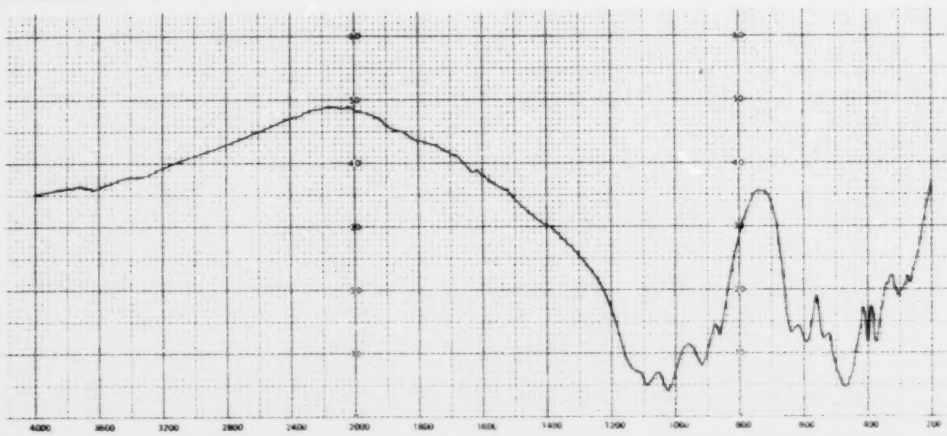
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
PIGEONITE		CLINO-PYROXENE		A124			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
(Mg,Fe,Ca) ₂ Si ₂ O ₆							
CRYSTAL SYSTEM	SPACE GROUP	a: 9.475	b: 8.953	c: 5.256	Z: 4	D: 3.66	
MONOCLINIC	P2 ₁ /c (14)	α:	β: 103°11'	γ:			
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC	
Loudoun Co., VIRGINIA, USA						2 mg	
					MAJOR ABSORPTION BANDS (cm ⁻¹)		
					D ₁	1063	S
						958	S
						877	MS
						749	MW
						665	MW
					D ₂	639	M
						498	S
						460	S
					D ₃	330	MS

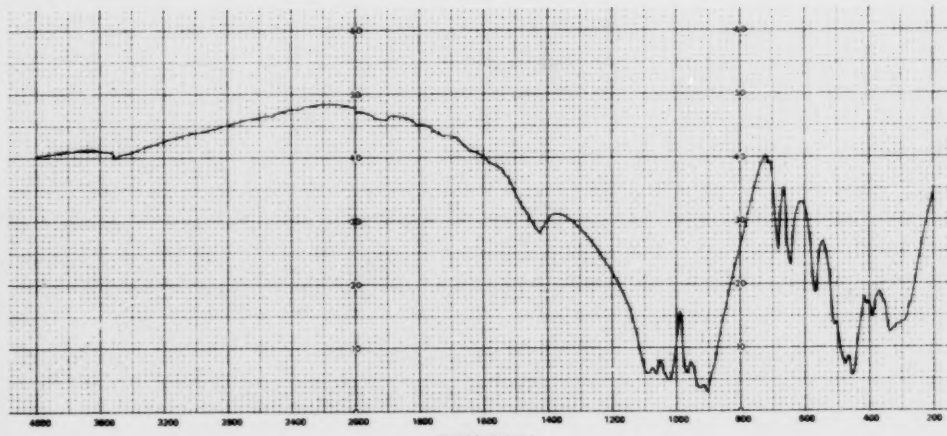
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
DIOPSIDE		CLINO-PYROXENE	INOSILICATES	A121
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CaMgSi ₂ O ₆		Mg _{1.3} Ca _{0.9} Fe _{0.1} Si _{1.8} O _{6.0} (EDXRA)		
CRYSTAL SYSTEM	SPACE GROUP	a: 9.93	b: 9.11	c: 5.26
MONOCLINIC	C2/C (15)	α:	β:105° 11'	γ:
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE
Birds Creek, Ontario, CANADA				CONC
				2 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)

MINERAL NAME AUGITE	SUB GROUP	GROUP PYROXENE	CLASS INOSILICATES	SPECTRA NO A258
CHEMICAL FORMULA (IDEAL) (Ca,Na)(Mg,Fe,Al,Ti)(Si,Al) ₂ O ₆		CHEMICAL FORMULA (ACTUAL) (Ca _{0.9} Mg _{0.8} Fe _{0.2} Al _{0.1})(Si _{1.7} Al _{0.3})O ₆ (EDXRA)		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP () a: 9.697 b: 8.936 c: 5.233 α: β: 105°02' γ: Z: 4 D:			
ORIGIN OF SAMPLE UNKNOWN	REMARKS		PARTICLE SIZE	CONC 1 mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			D ₁ 1063 ms 962 ms 870 ms	
			D ₂ 625 mw 504 ms 470 ms	
			D ₃ 403 ms 321 m	

MINERAL NAME ACMITE	SUB GROUP	GROUP CLINO-PYROXENE	CLASS INOSILICATES	SPECTRA NO A114
AEGIRINE	CHEMICAL FORMULA (IDEAL) NaFeSi ₂ O ₆		CHEMICAL FORMULA (ACTUAL) (Na _{0.6} Ca _{0.1} Mg _{0.1} Al _{0.1})(Fe _{1.0})Si _{2.1} O _{6.0} (EDXRA)	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/C (15)	a: 9.657 α:	b: 8.801 β: 107°43'	c: 5.291 γ: Z: 4 D: 3.576
ORIGIN OF SAMPLE Mont. Ste. Hilaire, QUEBEC	REMARKS			PARTICLE SIZE 2mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				D ₁ 1043) S
				1012) S
				949) S
				729) mw
D ₂ 637) m				
560) ms				
499) ms				
450) S				
D ₃ 380) S				
312) ms				

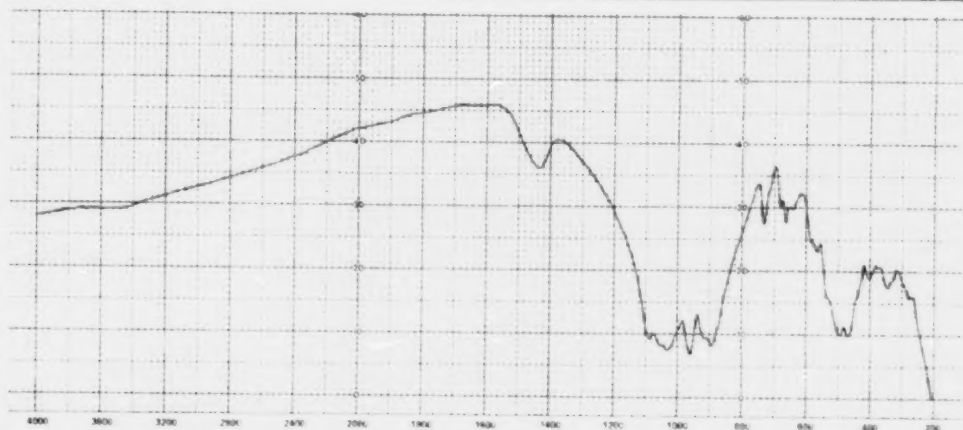
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
JADEITE		CLINO-PYROXENE	INOSILICATES	A115		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
NaAl(SiO ₃) ₂ or NaAlSi ₂ O ₆						
CRYSTAL SYSTEM	SPACE GROUP	a: 9.37	b: 8.61	c: 5.24		
MONOCLINIC	I2/a (15)	α:	β: 104° 48'	γ: Z: 4 D: 3.300		
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE		
BURMA				2 mg		
				MAJOR ABSORPTION BANDS (cm ⁻¹)		
				D ₁	1064	S
					1050	S
					988	S
					917	S
D	852	S				
D ₂	743	mw				
	659	ms				
	585	S				
D ₃	458	S				
	394	S				
	371	S				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																											
SPODUMENE		CLINO-PYROXENE	INOSILICATES	A128																											
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																													
LiAl[SiO ₃] ₂																															
CRYSTAL SYSTEM	SPACE GROUP																														
MONOCLINIC	I2 (9)	a: 9.089 α:	b: 8.386 β: 102° 30'	c: 5.215 γ: Z: 4 D: 3.19																											
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																											
Black Hill Mine, S. Dakota, USA				2 mg																											
			MAJOR ABSORPTION BANDS (cm ⁻¹)																												
			<table><tr><td></td><td>1085</td><td>S</td></tr><tr><td>D₁</td><td>1018</td><td>S</td></tr><tr><td></td><td>914</td><td>S</td></tr><tr><td></td><td>857</td><td>MS</td></tr><tr><td>D</td><td>D₂ 633</td><td>MS</td></tr><tr><td></td><td>588</td><td>S</td></tr><tr><td></td><td>532</td><td>S</td></tr><tr><td>D₃</td><td>463</td><td>S</td></tr><tr><td></td><td>396</td><td>S</td></tr><tr><td></td><td>369</td><td>S</td></tr></table>			1085	S	D ₁	1018	S		914	S		857	MS	D	D ₂ 633	MS		588	S		532	S	D ₃	463	S		396	S
	1085	S																													
D ₁	1018	S																													
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D	D ₂ 633	MS																													
	588	S																													
	532	S																													
D ₃	463	S																													
	396	S																													
	369	S																													

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																							
WOLLASTONITE			INOSILICATES	A120																																							
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																									
Ca [SiO ₃]																																											
CRYSTAL SYSTEM	SPACE GROUP																																										
TRICLINIC	P1 (1)	a: 7.88 α: 90 ⁰	b: 7.27 β: 95 ⁰ 16'	c: 7.03 γ: 103 ⁰ 25', Z: 6 D: 2.96																																							
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																							
Harrington, Twp., Quebec, CANADA				2 mg																																							
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																								
			<table><tr><td></td><td>1084</td><td>S</td></tr><tr><td></td><td>1056</td><td>S</td></tr><tr><td>D₁</td><td>1021</td><td>S</td></tr><tr><td></td><td>961</td><td>S</td></tr><tr><td></td><td>920</td><td>S</td></tr><tr><td></td><td>898</td><td>S</td></tr><tr><td>D</td><td>678</td><td>m</td></tr><tr><td>D₂</td><td>640</td><td>m</td></tr><tr><td></td><td>563</td><td>ms</td></tr><tr><td></td><td>504</td><td>ms</td></tr><tr><td></td><td>471</td><td>S</td></tr><tr><td>D₃</td><td>448</td><td>S</td></tr><tr><td></td><td>387</td><td>ms</td></tr><tr><td></td><td>330</td><td>S</td></tr></table>			1084	S		1056	S	D ₁	1021	S		961	S		920	S		898	S	D	678	m	D ₂	640	m		563	ms		504	ms		471	S	D ₃	448	S		387	ms
	1084	S																																									
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D ₁	1021	S																																									
	961	S																																									
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D	678	m																																									
D ₂	640	m																																									
	563	ms																																									
	504	ms																																									
	471	S																																									
D ₃	448	S																																									
	387	ms																																									
	330	S																																									

MINERAL NAME RHODONITE	SUB GROUP	GROUP	CLASS INOSILICATES	SPECTRA NO A125																										
CHEMICAL FORMULA (IDEAL) (Mn, Fe, Ca, Mg) [SiO ₃]		CHEMICAL FORMULA (ACTUAL)																												
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P $\bar{1}$ (2)	a: 7.6816 α : 92° 21'		b: 11.8180 β : 93° 57'																										
		c: 6.7073 γ : 105° 40'		Z: 10																										
ORIGIN OF SAMPLE Silverton, Montana, U.S.A.		REMARKS		PARTICLE SIZE 2 mg																										
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="0"> <tr><td>1076 \</td><td>S</td></tr> <tr><td>D₁ 1046</td><td>S</td></tr> <tr><td>1021</td><td>S</td></tr> <tr><td>950</td><td>S</td></tr> <tr><td>882</td><td>S</td></tr> <tr><td>D₂ 718</td><td>mw</td></tr> <tr><td>651</td><td>mw</td></tr> <tr><td>554</td><td>m</td></tr> <tr><td>488 \</td><td>S</td></tr> <tr><td>D₃ 458</td><td>S</td></tr> <tr><td>395)</td><td>ms</td></tr> <tr><td>383</td><td>ms</td></tr> <tr><td>326</td><td>ms</td></tr> </table>	1076 \	S	D ₁ 1046	S	1021	S	950	S	882	S	D ₂ 718	mw	651	mw	554	m	488 \	S	D ₃ 458	S	395)	ms	383	ms	326	ms
1076 \	S																													
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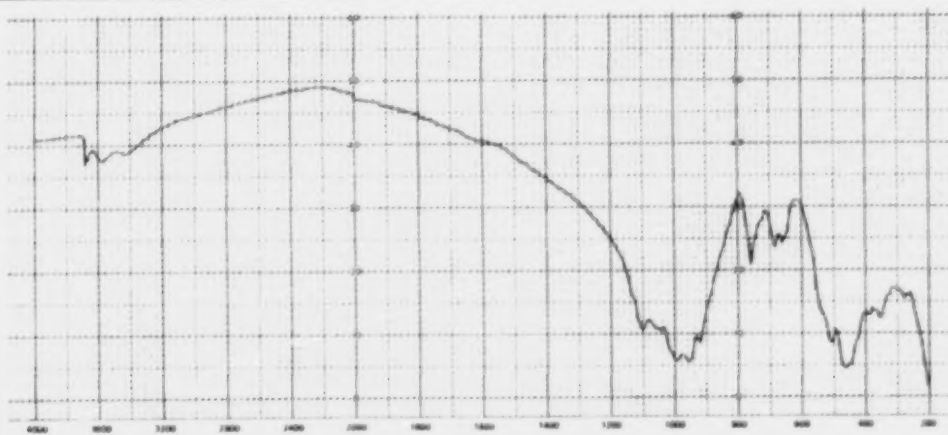
MINERAL NAME BUSTAMITE	SUB GROUP	GROUP	CLASS INOSILICATES	SPECTRA NO A127																						
CHEMICAL FORMULA (IDEAL) CaMn[(SiO ₃) ₂]		CHEMICAL FORMULA (ACTUAL)																								
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P $\bar{1}$ (2)	a: 7.736 α : 116° 58'		b: 7.755 β : 103° 52'																						
		c: 7.157 γ : 79° 31'		Z: 3																						
ORIGIN OF SAMPLE Franklin, New Jersey, USA		REMARKS		PARTICLE SIZE 2 mg																						
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table border="0"> <tr><td>1083</td><td>S</td></tr> <tr><td>1024</td><td>S</td></tr> <tr><td>D₁ 939</td><td>S</td></tr> <tr><td>904)</td><td>S</td></tr> <tr><td>688</td><td>m</td></tr> <tr><td>D₂ 664</td><td>mw</td></tr> <tr><td>558</td><td>ms</td></tr> <tr><td>456)</td><td>S</td></tr> <tr><td>D₃ 434</td><td>ms</td></tr> <tr><td>335</td><td>ms</td></tr> <tr><td>302)</td><td>ms</td></tr> </table>	1083	S	1024	S	D ₁ 939	S	904)	S	688	m	D ₂ 664	mw	558	ms	456)	S	D ₃ 434	ms	335	ms	302)	ms
1083	S																									
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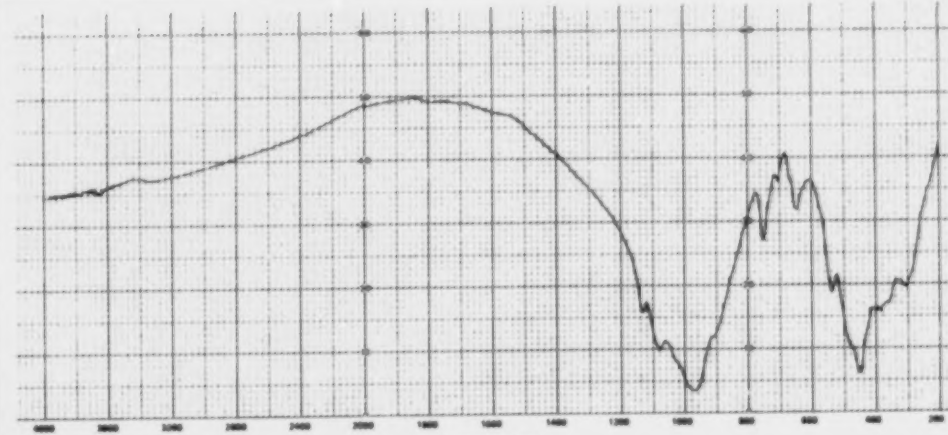
MINERAL NAME PYROXMANCITE	SUB GROUP	GROUP	CLASS INOSILICATES	SPECTRA NO A110
CHEMICAL FORMULA (IDEAL) Mn[SiO ₃]/(Fe, Mn, Ca, Mg)SiO ₃		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P $\bar{1}$ (2)	a: 7.557 b: 15.988 c: 6.671 α : 94° 31' β : 94° 18' γ : 91° 57' Z: 14 D: 3.81		
ORIGIN OF SAMPLE Shidara, Aichi, JAPAN	REMARKS		PARTICLE SIZE	CONC 2mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			1078) s	
			1041) s	
			D ₁ 1024) s	
			952) s	
			915) s	
			883) s	
			D ₂ 722) m	
			654) m	
			485) s	
			460) s	
			D ₃ 393) ms	
			335) ms	

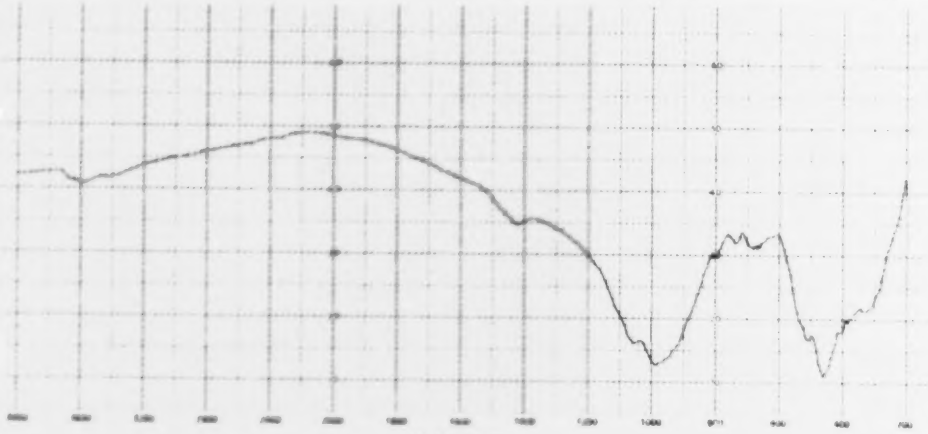
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
ANTHOPHYLLITE		AMPHIBOLE	INOSILICATES	A130
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
(Mg,Fe) ₇ Si ₈ O ₂₂ (OH) ₂				
CRYSTAL SYSTEM	SPACE GROUP			
ORTHORHOMBIC	Pmnb (62)	a: 17.94 α:	b: 18.58 β:	c: 5.29 γ: Z: 4 D: 3.105
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC	
Cashiers, N. Carolina, USA			2 mg	
		MAJOR ABSORPTION BANDS		
		(cm⁻¹)		
		A ₁	3680	w
			1098	s
		D ₁	1016	s
			986	s
			910	ms
			898	ms
			778	mw
		D ₂	751	mw
			709	mw
			688	m
			664	m
			529	s
		D ₃	492	s
			463	s
			446	s
			362	m

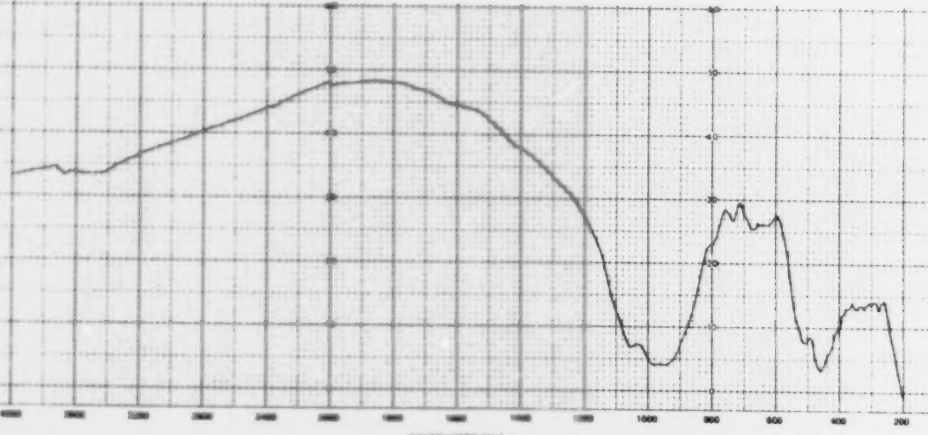
MINERAL NAME CUMMINGTONITE	SUB GROUP	GROUP AMPHIBOLE	CLASS INOSILICATES	SPECTRA NO A117																												
CHEMICAL FORMULA (IDEAL) $Mg_7Si_8O_{22}(OH)_2$		CHEMICAL FORMULA (ACTUAL) ($Ca_{1.5}Na_{1.0}K_{0.2}Fe_{0.2}$)($Mg_{4.9}Al_{0.1}$)($Si_{7.5}Al_{0.5}$) $O_{22}(OH)_2$ (EDXRA)																														
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 9.516 α :	b: 18.139 β : 102° 08'	c: 5.334 γ :																												
ORIGIN OF SAMPLE Lead, S. Dakota, USA		REMARKS	PARTICLE SIZE	CONC. 2 mg																												
			MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3550</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>990</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>870</td> <td>m</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>772</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>736</td> <td>m</td> </tr> <tr> <td></td> <td>D₃</td> <td>446</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>420</td> <td>ms</td> </tr> </table>		A	A ₂	3550	mw		D ₁	990	ms			870	m	D	D ₂	772	m			736	m		D ₃	446	ms			420	ms
A	A ₂	3550	mw																													
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D	D ₂	772	m																													
		736	m																													
	D ₃	446	ms																													
		420	ms																													

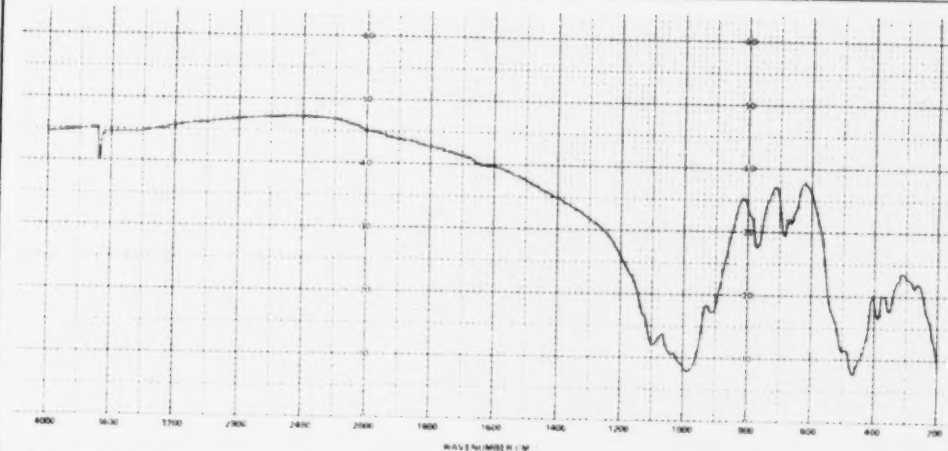
MINERAL NAME TREMOLITE	SUB GROUP	GROUP AMPHIBOLE	CLASS INOSILICATES	SPECTRA NO A257																																								
CHEMICAL FORMULA (IDEAL) $Ca_2Mg_5Si_8O_{22}(OH)_2$		CHEMICAL FORMULA (ACTUAL)																																										
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 9.81 α :	b: 17.95 β : 104° 45'	c: 5.27 γ :																																								
ORIGIN OF SAMPLE Ontario, CANADA		REMARKS	PARTICLE SIZE	CONC. 1 mg																																								
			MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3710</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>3680</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>1065</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₁</td> <td>979</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>917</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>739</td> <td>mw</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>665</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>660</td> <td>mw</td> </tr> <tr> <td></td> <td>D₃</td> <td>503</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>456</td> <td>s</td> </tr> </table>		A	A ₁	3710	w			3680	w			1065	s	D	D ₁	979	s			917	s			739	mw	D	D ₂	665	mw			660	mw		D ₃	503	s			456	s
A	A ₁	3710	w																																									
		3680	w																																									
		1065	s																																									
D	D ₁	979	s																																									
		917	s																																									
		739	mw																																									
D	D ₂	665	mw																																									
		660	mw																																									
	D ₃	503	s																																									
		456	s																																									

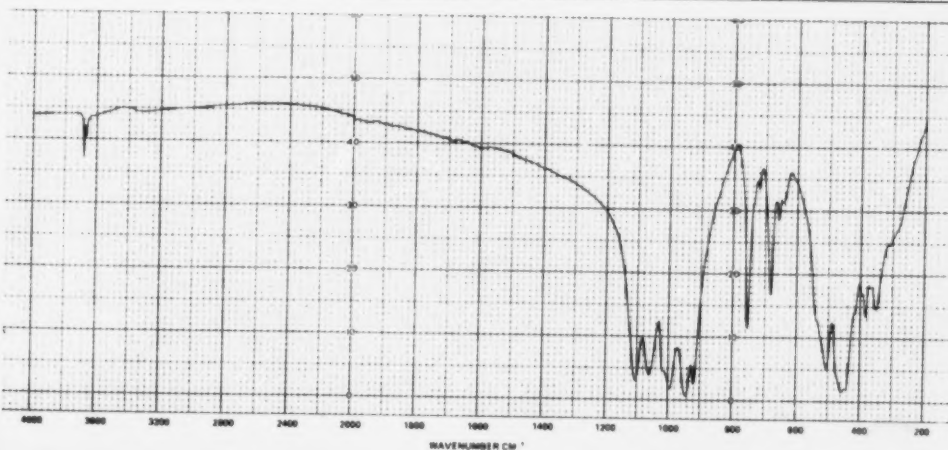
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.		
ACTINOLITE		AMPHIBOLE	INOSILICATES	A111		
		CHEMICAL FORMULA (IDEAL)	CHEMICAL FORMULA (ACTUAL)			
		$\text{Ca}_2(\text{Mg}, \text{Fe}^{2+})_5[\text{Si}_{18}\text{O}_{22}](\text{OH})_2$				
CRYSTAL SYSTEM	SPACE GROUP	a: ~9.86 α:	b: ~18.10 β: ~104°42' γ:	c: ~5.29 Z: 2 D: 3.131		
MONOCLINIC	C2/m (12)					
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.		
Chester, Vermont, USA				2 mg		
			MAJOR ABSORPTION BANDS (cm⁻¹)			
			A	A ₁	3680	mw
					3665	w
				A ₂	3575	w
					3420	w
			D		1097	s
				D ₁	990	s
					949	s
					917	s
					753	ms
D ₂	679	m				
	657	m				
	502	s				
D ₃	456	s				
	348	ms				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.		
HORNBLende		AMPHIBOLE	INOSILICATES	A122		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
(Ca, Na) ₂₋₃ (Mg, Fe ²⁺ , Fe ⁺³ , Al) ₅ (Al)		(Ca _{1.65} Na _{0.99} K _{0.24})(Mg _{2.85} Fe ²⁺ _{1.68} Fe ³⁺ _{0.32} Al _{0.28} Mn _{0.08}) ⁺				
CRYSTAL SYSTEM	SPACE GROUP	a: 9.825 α:	b: 18.082 β: 104°50' γ:	c: 5.308 Z: 2 D: 3.26		
MONOCLINIC	C2/m (12)					
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.		
Faraday Twp., ONTARIO, CANADA	* (Si _{6.48} Al _{1.32} O ₂₂ (OH) ₂			2mg		
			MAJOR ABSORPTION BANDS (cm⁻¹)			
			A	A ₁	3650	w
					1128	ms
			D ₁		1078	s
					965	s
D	D ₂	747	m			
		641	mw			
	D ₃	534	ms			
		448	s			

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																					
EDENITE		AMPHIBOLE	INOSILICATES	A126																					
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																							
NaCa ₂ Mg ₅ (AlSi ₇)O ₂₂ (OH) ₂																									
CRYSTAL SYSTEM	SPACE GROUP																								
MONOCLINIC	C2/m (12)	a: 9.837 α:	b: 17.954 β: 105.18°	c: 5.307 γ:																					
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC.																					
Edenville, New York, USA				2mg																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																						
			<table><tr><td>A₁</td><td>3660</td><td>W</td></tr><tr><td>A₂</td><td>3575</td><td>W</td></tr><tr><td>D₁</td><td>1050</td><td>ms</td></tr><tr><td></td><td>981</td><td>S</td></tr><tr><td>D₂</td><td>732</td><td>mw</td></tr><tr><td></td><td>680</td><td>mw</td></tr><tr><td>D₃</td><td>506</td><td>ms</td></tr><tr><td></td><td>459</td><td>S</td></tr></table>		A ₁	3660	W	A ₂	3575	W	D ₁	1050	ms		981	S	D ₂	732	mw		680	mw	D ₃	506	ms
A ₁	3660	W																							
A ₂	3575	W																							
D ₁	1050	ms																							
	981	S																							
D ₂	732	mw																							
	680	mw																							
D ₃	506	ms																							
	459	S																							

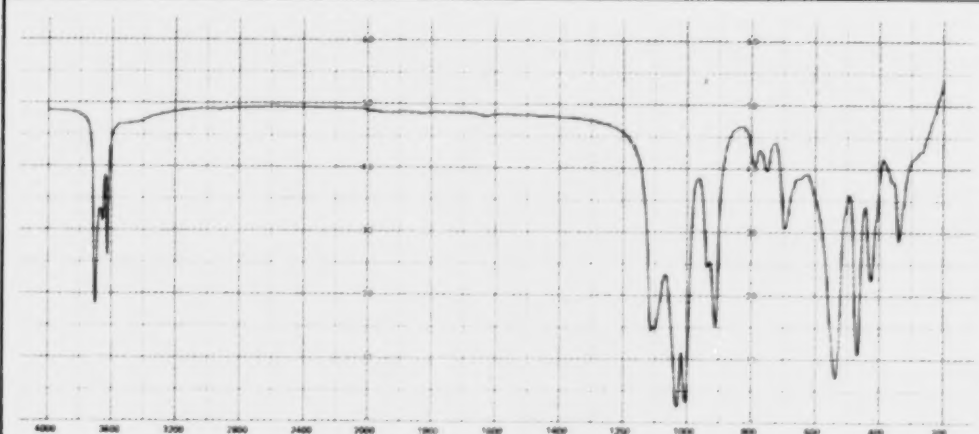
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.																														
RIEBECKITE		AMPHIBOLE	INOSILICATES	A112																														
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																
$\text{Na}_2(\text{Fe}^{+2}, \text{Mg}, \text{Fe}^{+3})_5[\text{Si}_8\text{O}_{22}](\text{OH})_2$																																		
CRYSTAL SYSTEM	SPACE GROUP																																	
MONOCLINIC	$C2/m (12)$	$a: 9.73$ $\alpha:$	$b: 18.07$ $\beta: 103^\circ 24'$	$c: 5.33$ $\gamma:$																														
Z: 2		D: 3.380																																
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC.																															
El Paso Co. Colorado, USA			2 mg																															
		MAJOR ABSORPTION BANDS (cm⁻¹)																																
		<table><tr><td>A</td><td>A₁</td><td>3665</td><td>mw</td></tr><tr><td></td><td></td><td>1051</td><td>S</td></tr><tr><td></td><td>D₁</td><td>979</td><td>S</td></tr><tr><td></td><td></td><td>942</td><td>S</td></tr><tr><td>D</td><td>D₂</td><td>729</td><td>m</td></tr><tr><td></td><td></td><td>668</td><td>m</td></tr><tr><td></td><td>D₃</td><td>504</td><td>S</td></tr><tr><td></td><td></td><td>456</td><td>S</td></tr></table>			A	A ₁	3665	mw			1051	S		D ₁	979	S			942	S	D	D ₂	729	m			668	m		D ₃	504	S		
A	A ₁	3665	mw																															
		1051	S																															
	D ₁	979	S																															
		942	S																															
D	D ₂	729	m																															
		668	m																															
	D ₃	504	S																															
		456	S																															

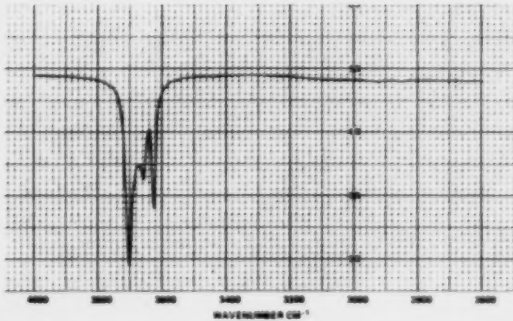
MINERAL NAME TIRODITE	SUB GROUP	GROUP AMPHIBOLE	CLASS INOSILICATES	SPECTRA NO A113																																												
CHEMICAL FORMULA (IDEAL) (Mg,Mn) ₇ [Si ₈ O ₂₂](OH) ₂		CHEMICAL FORMULA (ACTUAL)																																														
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 9.799 α:	b: 17.994 β: 103.89°	c: 5.289 γ:																																												
ORIGIN OF SAMPLE St. Lawrence Co. New York, USA		REMARKS		PARTICLE SIZE 2 mg																																												
				MAJOR ABSORPTION BANDS (cm ⁻¹)																																												
				<table><tr><td>A</td><td>A₁</td><td>3678</td><td>w</td></tr><tr><td></td><td></td><td>1097</td><td>s</td></tr><tr><td></td><td></td><td>1037</td><td>s</td></tr><tr><td></td><td>D₁</td><td>990</td><td>s</td></tr><tr><td></td><td></td><td>910</td><td>ms</td></tr><tr><td>D</td><td>D₂</td><td>771</td><td>m</td></tr><tr><td></td><td></td><td>685</td><td>mw</td></tr><tr><td></td><td></td><td>665</td><td>mw</td></tr><tr><td></td><td></td><td>499</td><td>s</td></tr><tr><td></td><td>D₃</td><td>466</td><td>s</td></tr><tr><td></td><td></td><td>388</td><td>ms</td></tr><tr><td></td><td></td><td>351</td><td>ms</td></tr></table>	A	A ₁	3678	w			1097	s			1037	s		D ₁	990	s			910	ms	D	D ₂	771	m			685	mw			665	mw			499	s		D ₃	466	s			388	ms
A	A ₁	3678	w																																													
		1097	s																																													
		1037	s																																													
	D ₁	990	s																																													
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D	D ₂	771	m																																													
		685	mw																																													
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		499	s																																													
	D ₃	466	s																																													
		388	ms																																													
		351	ms																																													

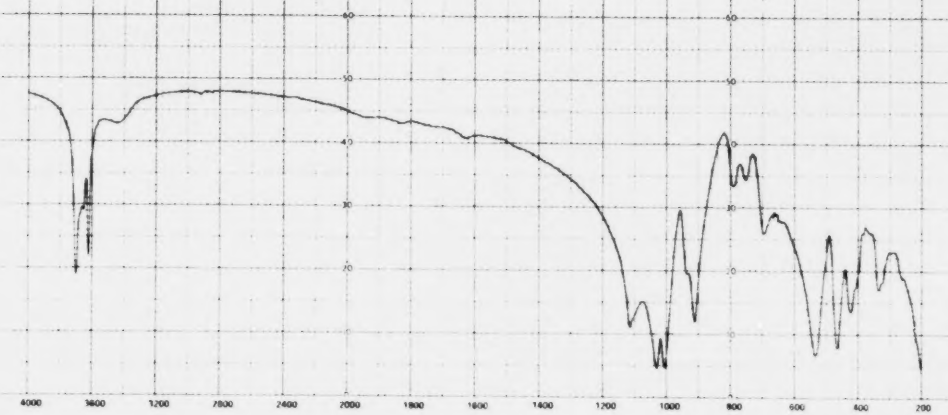
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																														
NEPHRITE		AMPHIBOLE	INOSILICATES	A131																																																														
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																																
$\text{Ca}_2(\text{Mg, Fe})_4[\text{Si}_{18}\text{O}_{22}](\text{OH})_2$																																																																		
CRYSTAL SYSTEM	SPACE GROUP																																																																	
MONOCLINIC	$C2/m (12)$	$a: 9.85$ $\alpha:$	$b: 18.1$ $\beta: 104^{\circ}50'$	$c: 5.3$ $\gamma:$																																																														
		Z: 2	D: 3.2																																																															
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC																																																															
TAIWAN			2 mg																																																															
		MAJOR ABSORPTION BANDS (cm^{-1})																																																																
		<table><tr><td>A</td><td>A₁</td><td>3685</td><td>mw</td></tr><tr><td></td><td></td><td>3670</td><td>w</td></tr><tr><td></td><td></td><td>1104</td><td>s</td></tr><tr><td></td><td></td><td>1061</td><td>s</td></tr><tr><td></td><td>D₁</td><td>995</td><td>s</td></tr><tr><td></td><td></td><td>945</td><td>s</td></tr><tr><td></td><td></td><td>920</td><td>s</td></tr><tr><td></td><td></td><td>752</td><td>s</td></tr><tr><td>D₂</td><td></td><td>719</td><td>mw</td></tr><tr><td></td><td></td><td>681</td><td>ms</td></tr><tr><td></td><td></td><td>657</td><td>nw</td></tr><tr><td></td><td></td><td>504</td><td>s</td></tr><tr><td></td><td></td><td>454</td><td>s</td></tr><tr><td>D₃</td><td></td><td>443</td><td>s</td></tr><tr><td></td><td></td><td>383</td><td>ms</td></tr><tr><td></td><td></td><td>351</td><td>ms</td></tr></table>			A	A ₁	3685	mw			3670	w			1104	s			1061	s		D ₁	995	s			945	s			920	s			752	s	D ₂		719	mw			681	ms			657	nw			504	s			454	s	D ₃		443	s			383	ms		
A	A ₁	3685	mw																																																															
		3670	w																																																															
		1104	s																																																															
		1061	s																																																															
	D ₁	995	s																																																															
		945	s																																																															
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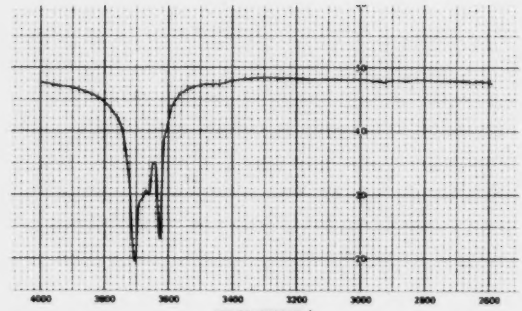
MINERAL NAME BARKEVIKITE	SUB GROUP	GROUP AMPHIBOLE	CLASS INOSILICATES	SPECTRA NO. A119																																					
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																							
(Na,K)Ca ₂ (Fe,Mg,Ti) ₅ [(Al,Si) ₈ O ₂₂](OH) ₂																																									
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 9.92 α:	b: 18.30 β: 105° 45'	c: 5.33 γ: Z: 2 D: 3.4																																					
ORIGIN OF SAMPLE San Benito, Co., California, USA	REMARKS		PARTICLE SIZE	CONC. 2 mg																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																						
			<table border="0"> <tr> <td>A</td> <td>Al</td> <td>3665</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>1090</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>1045</td> <td>s</td> </tr> <tr> <td>D</td> <td>1</td> <td>980</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>942</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>915</td> <td>s</td> </tr> <tr> <td>D</td> <td>2</td> <td>677</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>666</td> <td>m</td> </tr> <tr> <td></td> <td>D</td> <td>499</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>453</td> <td>s</td> </tr> </table>		A	Al	3665	mw			1090	ms			1045	s	D	1	980	s			942	s			915	s	D	2	677	m			666	m		D	499	s	
A	Al	3665	mw																																						
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		666	m																																						
	D	499	s																																						
		453	s																																						

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α:	β:	γ:
				Z:
				D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
KAOLINITE	DIOCTAHEDRAL	KAOLINITE-SERPENTINE	PHYLLOSILICATES	166			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
Al ₂ Si ₂ O ₅ (OH) ₄		Al _{2.00} (Si _{1.98} Al _{0.02}) ₂ O ₅ (OH) ₄					
CRYSTAL SYSTEM	SPACE GROUP	a: 5.139 α: 91.6°	b: 8.932 β: 104.8°	c: 7.371 γ: 89.9°			
TRICLINIC	C1 (1)	Z: 2	D: 2.594				
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Macon, Georgia, USA				1-2 μm			
				CONC			
				0.7 mg			
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
				A	A ₁	3702	ms
						3657	mw
						3625	m
						1105	ms
						1032	s
					D ₁	1007	s
						912	ms
				D		789	w
					D ₂	751	mw
		695	mw				
		539	s				
	D ₃	470	s				
		429	ms				
		341	mw				

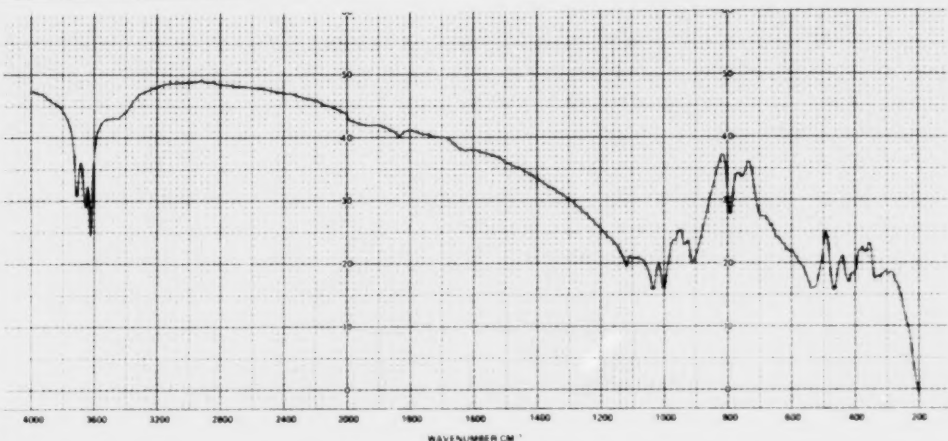
MINERAL NAME KAOLINITE	SUB GROUP	GROUP	CLASS	SPECTRA NO 166		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ :	Z:	D:
ORIGIN OF SAMPLE Macon, Georgia, USA	REMARKS			PARTICLE SIZE	CONC mg	
				MAJOR ABSORPTION BANDS (cm⁻¹)		
				A ₁ 3702 ms 3685 sh 3657 mw 3625 m		

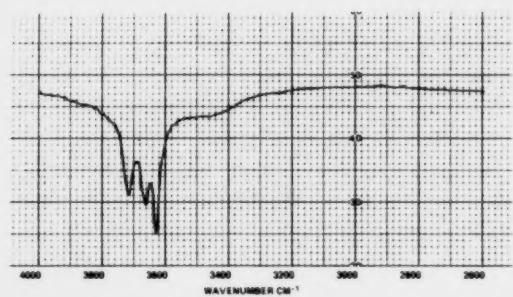
MINERAL NAME KAOLINITE	SUB-GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO 170
CHEMICAL FORMULA (IDEAL) $Al_2Si_2O_5(OH)_4$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP C1 (1)	a: 5.139 α: 91.6°	b: 8.932 β: 104.8°	c: 7.371 γ: 89.9°
ORIGIN OF SAMPLE Jones, California, USA		REMARKS	PARTICLE SIZE	CONC 0.7 mg
			MAJOR ABSORPTION BANDS (cm⁻¹) A A ₁ 3705 ms 3660 mw 3627 ms 1115 s D ₁ 1032 s 1008 s 913 s D 791 mw D ₂ 752 mw 695 m 535 s D ₃ 468 s 425 ms 336 ms	

MINERAL NAME KAOLINITE	SUB-GROUP	GROUP	CLASS	SPECTRA NO 170
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
ORIGIN OF SAMPLE Jones, California, USA		REMARKS	PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹) A ₁ 3705 ms 3680 sh 3660 mw 3627 ms	

MINERAL NAME KAOLINITE	SUB GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO 169																																
CHEMICAL FORMULA (IDEAL) $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:																																
ORIGIN OF SAMPLE Yangambi Zaire, AFRICA	REMARKS	PARTICLE SIZE	CONC 0.7mg																																	
		MAJOR ABSORPTION BANDS (cm^{-1})																																		
		<table border="0"> <tr> <td>A</td> <td>3705</td> <td>ms</td> </tr> <tr> <td rowspan="3">A₁</td> <td>3655</td> <td>m</td> </tr> <tr> <td>3628</td> <td>ms</td> </tr> <tr> <td>1100</td> <td>s</td> </tr> <tr> <td rowspan="3">D₁</td> <td>1032</td> <td>s</td> </tr> <tr> <td>1005</td> <td>s</td> </tr> <tr> <td>911</td> <td>ms</td> </tr> <tr> <td rowspan="3">D</td> <td>789</td> <td>mw</td> </tr> <tr> <td>747</td> <td>mw</td> </tr> <tr> <td>691</td> <td>m</td> </tr> <tr> <td rowspan="3">D₃</td> <td>537</td> <td>s</td> </tr> <tr> <td>468</td> <td>s</td> </tr> <tr> <td>425</td> <td>ms</td> </tr> <tr> <td></td> <td>339</td> <td>m</td> </tr> </table>			A	3705	ms	A ₁	3655	m	3628	ms	1100	s	D ₁	1032	s	1005	s	911	ms	D	789	mw	747	mw	691	m	D ₃	537	s	468	s	425	ms	
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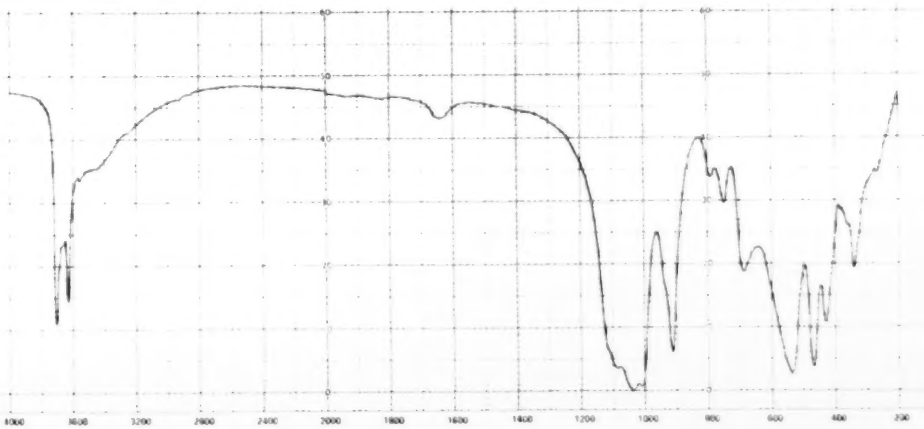
MINERAL NAME KAOLINITE	SUB GROUP	GROUP	CLASS	SPECTRA NO 169
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE Yangambi, Zaire, AFRICA	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm^{-1})		

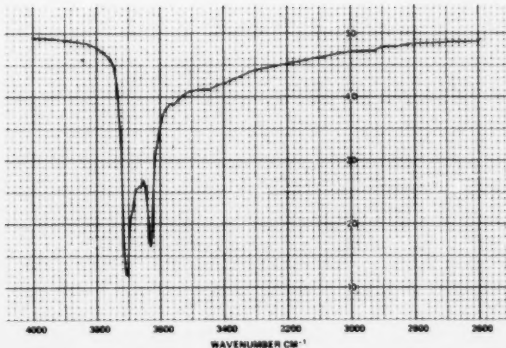
MINERAL NAME DICKITE (2M₁)	SUB GROUP DIOTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO 424																																									
CHEMICAL FORMULA (IDEAL) Al₂Si₂O₅(OH)₄		CHEMICAL FORMULA (ACTUAL)																																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP Cc (9)	a: 5.15 α:	b: 8.94 β: 103.58°	c: 14.736 γ: Z: 4 D: 2.599																																									
ORIGIN OF SAMPLE Pattsville, Pennsylvania, USA	REMARKS		PARTICLE SIZE	CONC 2mg																																									
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																										
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3718</td><td>mw</td></tr> <tr><td></td><td></td><td>3662</td><td>mw</td></tr> <tr><td></td><td></td><td>3630</td><td>m</td></tr> <tr><td></td><td></td><td>1171</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>1031</td><td>ms</td></tr> <tr><td></td><td></td><td>999</td><td>ms</td></tr> <tr><td></td><td></td><td>909</td><td>ms</td></tr> <tr><td></td><td>D₂</td><td>791</td><td>m</td></tr> <tr><td></td><td></td><td>531</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>465</td><td>ms</td></tr> <tr><td></td><td></td><td>416</td><td>ms</td></tr> </table>		A	A ₁	3718	mw			3662	mw			3630	m			1171	ms		D ₁	1031	ms			999	ms			909	ms		D ₂	791	m			531	ms		D ₃	465	ms	
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		416	ms																																										

MINERAL NAME DICKITE (2M₁)	SUB GROUP	GROUP	CLASS	SPECTRA NO 424
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE Pattsville, Pennsylvania, USA	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME NACRITE ($2M_2$)	SUB GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLOSILICATES	SPECTRA NO 171																																																										
CHEMICAL FORMULA (IDEAL) $Al_2Si_2O_5(OH)_4$		CHEMICAL FORMULA (ACTUAL)																																																												
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP Cc (9)	a: 8.909 α :	b: 5.146 β : 113.70°	c: 15.697 γ : Z: 4 D: 2.582																																																										
ORIGIN OF SAMPLE Kasuga Mine, Kagoshima, JAPAN	REMARKS	PARTICLE SIZE	CONC 0.7 mg																																																											
		MAJOR ABSORPTION BANDS (cm^{-1})																																																												
		<table border="0"> <tr><td>A</td><td>A₁</td><td>3710</td><td>mw</td></tr> <tr><td></td><td></td><td>3655</td><td>m</td></tr> <tr><td></td><td></td><td>3623</td><td>ms</td></tr> <tr><td></td><td></td><td>1128</td><td>ms</td></tr> <tr><td></td><td></td><td>1032</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>998</td><td>s</td></tr> <tr><td></td><td></td><td>935</td><td>s</td></tr> <tr><td></td><td></td><td>910</td><td>ms</td></tr> <tr><td></td><td></td><td>791</td><td>mw</td></tr> <tr><td></td><td>D₂</td><td>749</td><td>mw</td></tr> <tr><td></td><td></td><td>686</td><td>mw</td></tr> <tr><td></td><td></td><td>535</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>467</td><td>s</td></tr> <tr><td></td><td></td><td>422</td><td>ms</td></tr> <tr><td></td><td></td><td>339</td><td>ms</td></tr> </table>			A	A ₁	3710	mw			3655	m			3623	ms			1128	ms			1032	s		D ₁	998	s			935	s			910	ms			791	mw		D ₂	749	mw			686	mw			535	s		D ₃	467	s			422	ms		
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		686	mw																																																											
		535	s																																																											
	D ₃	467	s																																																											
		422	ms																																																											
		339	ms																																																											

MINERAL NAME NACRITE	SUB GROUP	GROUP	CLASS	SPECTRA NO 171
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α :	β :	γ :
				Z:
				D:
ORIGIN OF SAMPLE Kasuga Mine, Kagoshima, JAPAN	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm^{-1})		

MINERAL NAME HALLOYSITE-7Å	SUB GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLOSILICATES	SPECTRA NO 167																																				
CHEMICAL FORMULA (IDEAL) $Al_2Si_2O_5(OH)_4$		CHEMICAL FORMULA (ACTUAL)																																						
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.14 α:	b: 8.90 β: -100°	c: 75~7.9 γ:																																				
ORIGIN OF SAMPLE Gaspe, Quebec, CANADA		REMARKS	PARTICLE SIZE	CONC. 0.7 mg																																				
			MAJOR ABSORPTION BANDS (cm⁻¹)																																					
			<table border="1"> <tr> <td>A₁</td> <td>3702</td> <td>s</td> </tr> <tr> <td></td> <td>3632</td> <td>s</td> </tr> <tr> <td>A₂</td> <td>3555sh</td> <td>mw</td> </tr> <tr> <td></td> <td>1090</td> <td>s</td> </tr> <tr> <td>D₁</td> <td>1038</td> <td>s</td> </tr> <tr> <td></td> <td>1005</td> <td>s</td> </tr> <tr> <td></td> <td>913</td> <td>s</td> </tr> <tr> <td>D₂</td> <td>750</td> <td>mw</td> </tr> <tr> <td></td> <td>688</td> <td>ms</td> </tr> <tr> <td></td> <td>537</td> <td>s</td> </tr> <tr> <td>D₃</td> <td>470</td> <td>s</td> </tr> <tr> <td></td> <td>430</td> <td>s</td> </tr> <tr> <td></td> <td>340</td> <td>ms</td> </tr> </table>		A ₁	3702	s		3632	s	A ₂	3555sh	mw		1090	s	D ₁	1038	s		1005	s		913	s	D ₂	750	mw		688	ms		537	s	D ₃	470	s		430	s
A ₁	3702	s																																						
	3632	s																																						
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	913	s																																						
D ₂	750	mw																																						
	688	ms																																						
	537	s																																						
D ₃	470	s																																						
	430	s																																						
	340	ms																																						

MINERAL NAME HALLOYSITE-7Å	SUB GROUP	GROUP	CLASS	SPECTRA NO 167
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
ORIGIN OF SAMPLE Gaspe, Quebec, CANADA		REMARKS	PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME HALLOYSITE-7$\bar{A}$	SUB GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO A224																																							
CHEMICAL FORMULA (IDEAL) $Al_2Si_2O_5(OH)_4$		CHEMICAL FORMULA (ACTUAL)																																									
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.14 α :	b: 8.90 β : $\sim 100^\circ$	c: 7.5-7.9 γ : Z: 2 D: ~ 2.2																																							
ORIGIN OF SAMPLE Bedford, Indiana, USA	REMARKS		PARTICLE SIZE	CONC 1 mg																																							
			MAJOR ABSORPTION BANDS (cm^{-1})																																								
			<table border="0"> <tr><td>A₁</td><td>3713</td><td>ms</td></tr> <tr><td></td><td>3637</td><td>ms</td></tr> <tr><td>A₂</td><td>3560</td><td>mw</td></tr> <tr><td></td><td>3483</td><td>mw</td></tr> <tr><td></td><td>1111</td><td>sh s</td></tr> <tr><td></td><td>1075</td><td>sh s</td></tr> <tr><td>D₁</td><td>1031</td><td>s</td></tr> <tr><td></td><td>1013</td><td>sh s</td></tr> <tr><td></td><td>910</td><td>s</td></tr> <tr><td>D₂</td><td>749</td><td>m</td></tr> <tr><td></td><td>532</td><td>s</td></tr> <tr><td>D₃</td><td>467</td><td>s</td></tr> <tr><td></td><td>428</td><td>s</td></tr> <tr><td></td><td>338</td><td>ms</td></tr> </table>		A ₁	3713	ms		3637	ms	A ₂	3560	mw		3483	mw		1111	sh s		1075	sh s	D ₁	1031	s		1013	sh s		910	s	D ₂	749	m		532	s	D ₃	467	s		428	s
A ₁	3713	ms																																									
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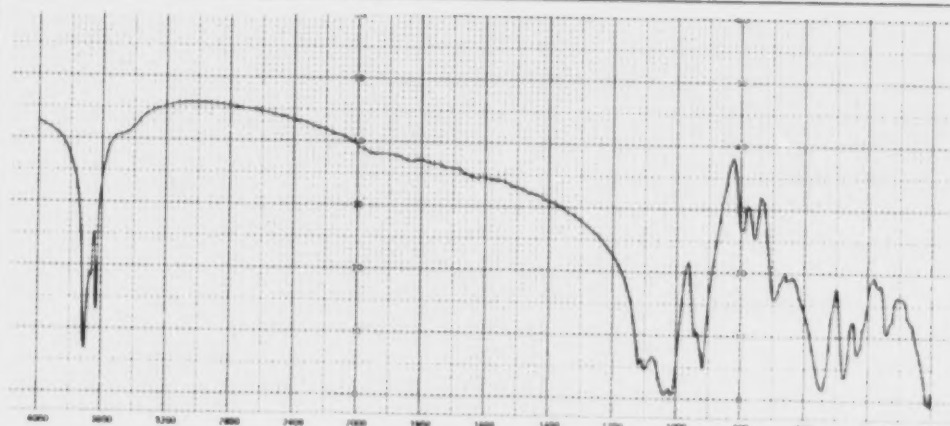
MINERAL NAME HALLOYSITE	SUB GROUP	GROUP	CLASS	SPECTRA NO A224
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE Bedford, Indiana, USA	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

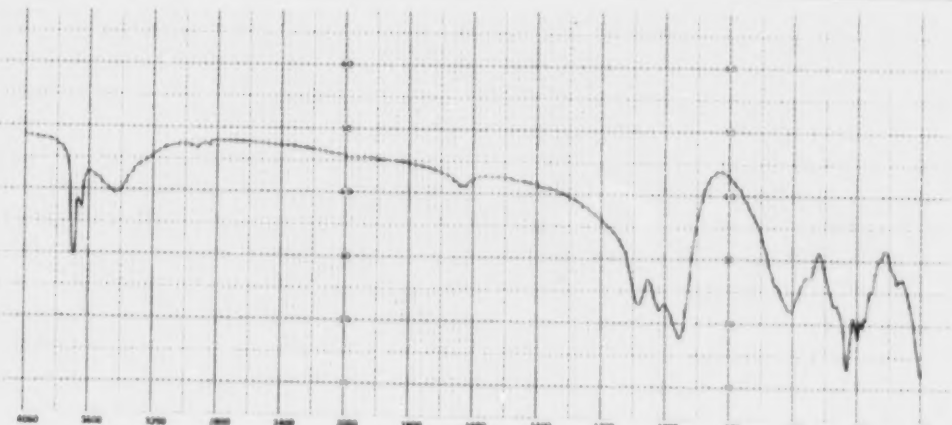
MINERAL NAME HALLOYSITE-10⁸	SUB GROUP	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO A226																																															
CHEMICAL FORMULA (IDEAL) $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																																	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.14 α:	b: 8.90 β:	c: 10 γ: Z: 2 D:																																															
ORIGIN OF SAMPLE Eureka, Utah, USA	REMARKS		PARTICLE SIZE	CONC 1 mg																																															
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																
			<table border="1"> <tbody> <tr> <td>A₁</td> <td>3708</td> <td>ms</td> </tr> <tr> <td></td> <td>3635</td> <td>ms</td> </tr> <tr> <td>A</td> <td>A₂</td> <td>3538</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>3460</td> <td>m</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1633</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1040</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>915</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>745</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>680</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>531</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>465</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>427</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>339</td> <td>ms</td> </tr> </tbody> </table>		A ₁	3708	ms		3635	ms	A	A ₂	3538	m			3460	m	B	B ₂	1633	mw		D ₁	1040	s			915	s	D	D ₂	745	m			680	ms			531	s		D ₃	465	s			427	s	
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		531	s																																																
	D ₃	465	s																																																
		427	s																																																
		339	ms																																																

MINERAL NAME HALLOYSITE-10⁸	SUB GROUP	GROUP	CLASS	SPECTRA NO A226
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a:	b:	c:
		α:	β:	γ:
				Z: D:
ORIGIN OF SAMPLE Eureka, Utah, USA	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME HALLOYSITE-10Å	SUB GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SEPTENTINE	CLASS PHYLLOSILICATES	SPECTRUM B198
CHEMICAL FORMULA (IDEAL) $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.14 α:	b: 8.07 β: <100°	c: 10 γ: Z: D:
ORIGIN OF SAMPLE Tsukinokawa, Nagasaki Pref., JAPAN	REMARKS		PARTICLE SIZE	CONC. 1 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			3700 ms 3625 sh ms 3610 s 3560 ms 1635 m 1110 s 1030 1007 vs 972 sh m 910 s 878 sh w 785 sh w 753 m 697 sh 670 mw 550 s	

MINERAL NAME HALLOYSITE-10Å	SUB GROUP	GROUP	CLASS	SPECTRUM B198
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: b: c: Z: D:		
ORIGIN OF SAMPLE Tsukinokawa, Nagasaki Pref., JAPAN	REMARKS		PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			472 s 432 ms 338 m	

MINERAL NAME KAOLINITE	SUB GROUP DIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO A220
CHEMICAL FORMULA (IDEAL) Al ₂ Si ₂ O ₅ (OH) ₄		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP C1 (1)	a: 5.139 α: 91.6°	b: 8.932 β: 104.8°	c: 7.371 γ: 89.9°
ORIGIN OF SAMPLE Mesa, Alberta, CANADA		REMARKS		Z: 2 D: 2.594
PARTICLE SIZE		CONC 2mg		
		MAJOR ABSORPTION BANDS (cm⁻¹)		
		A ₁	3703	s
			3628	ms
			1112	s
			1093	s
			1031	s
		D ₁	1010	s
			936	s
			911	s
			792	m
D ₂	785	m		
	688	ms		
	537	s		
D ₃	468	s		
	427	s		
	335	s		

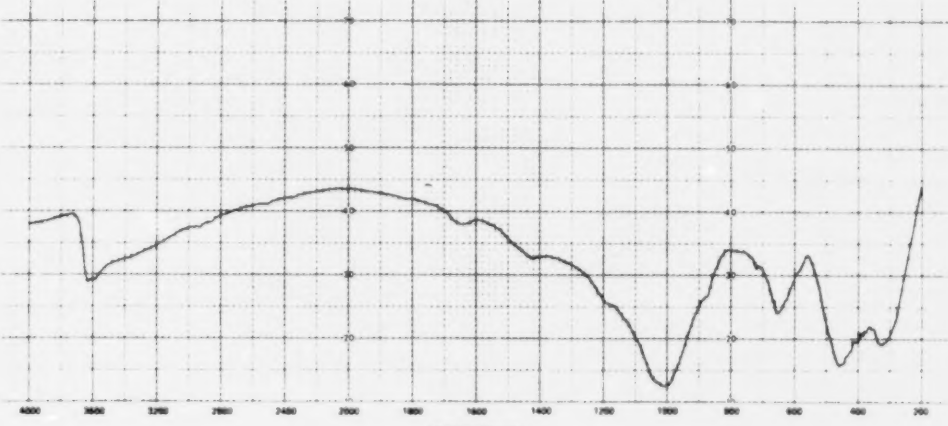
MINERAL NAME	SUB GROUP	GROUP	KAOLINITE-SERPENTINE	CLASS	PHYLLOSILICATES	SPECTRA NO	A174
CHRYSOTILE (2M)	TRIOCTAHEDRAL						
		CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)			
		Mg ₃ Si ₂ O ₅ (OH) ₄					
CRYSTAL SYSTEM	SPACE GROUP						
MONOCLINIC	()	a: 5.313	b: 9.120	c: 14.637	Z: 4		D: 2.61
		α:		β: 93°10'		γ:	
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE	CONC		
Asbestos, Quebec, CANADA					1 mg		
				MAJOR ABSORPTION BANDS (cm⁻¹)			
				A	A ₁	3700	mw
						3653	w
						1080	m
					D ₁	1014	ms
						950	ms
				D	D ₂	603	ms
						429	s
					D ₃	396	ms
						381	ms

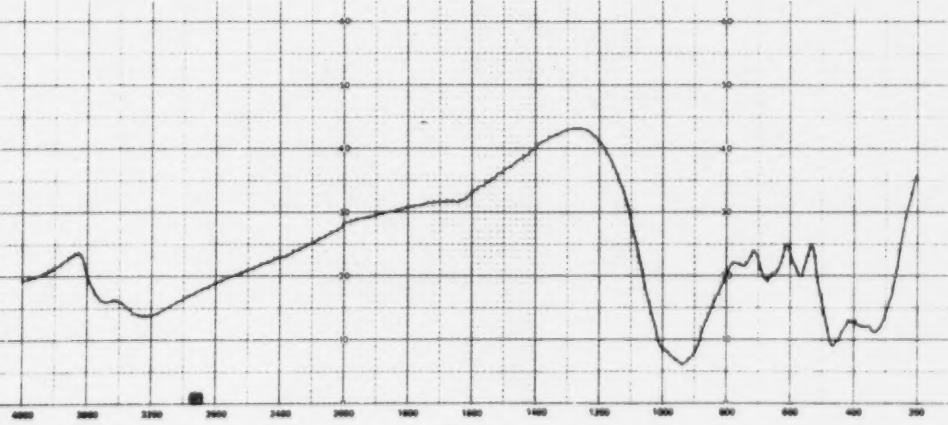
MINERAL NAME CHRYSTILE	SUB GROUP TRIOCTAHEDRAL	GROUP KAOLINITE- SERPENTINE	CLASS PHYLOSILICATES	SPECTRA NO 172																									
CHEMICAL FORMULA (IDEAL) $Mg_3Si_2O_5(OH)_4$		CHEMICAL FORMULA (ACTUAL)																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.313 a:	b: 9.120 $\beta: 93^\circ 10'$	c: 14.637 $\gamma:$																									
		Z: 4	D: 2.61																										
ORIGIN OF SAMPLE Maruo, Ube, Yamaguchi, JAPAN	REMARKS		PARTICLE SIZE	CONC 0.7 mg																									
			MAJOR ABSORPTION BANDS (cm^{-1})																										
			<table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3695</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>3650</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1075</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>987</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>612</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>434</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>400</td> <td>s</td> </tr> </table>		A	A ₁	3695	ms			3650	mw		D ₁	1075	ms			987	s	D	D ₂	612	ms			434	s	
A	A ₁	3695	ms																										
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D	D ₂	612	ms																										
		434	s																										
	D ₃	400	s																										

MINERAL NAME CHRYSTILE	SUB GROUP	GROUP	CLASS	SPECTRA NO 172
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: a:	b: $\beta:$	c: $\gamma:$
		Z:	D:	
ORIGIN OF SAMPLE Maruo, Ube, Yamaguchi, JAPAN	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

MINERAL NAME CHRYSOTILE	SUB GROUP TRIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO A183																									
CHEMICAL FORMULA (IDEAL) Mg₃Si₂O₅(OH)₄		CHEMICAL FORMULA (ACTUAL)																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.313 α:	b: 9.120 β: 93° 10'	c: 14.637 γ: Z: 4 D: 2.61																									
ORIGIN OF SAMPLE Spinel Brook, Newfoundland, CANADA	REMARKS		PARTICLE SIZE	CONC 1 mg																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																										
			<table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3702</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>3655</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1086</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>954</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>605</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>430</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>396</td> <td>ms</td> </tr> </table>		A	A ₁	3702	mw			3655	mw		D ₁	1086	ms			954	ms	D	D ₂	605	ms			430	s	
A	A ₁	3702	mw																										
		3655	mw																										
	D ₁	1086	ms																										
		954	ms																										
D	D ₂	605	ms																										
		430	s																										
	D ₃	396	ms																										

MINERAL NAME PECORAITE	SUB GROUP TRIOCTAHEDRAL	GROUP KAOLINITE-SERPENTINE	CLASS PHYLLOSILICATES	SPECTRA NO A176																	
CHEMICAL FORMULA (IDEAL) Ni₃Si₂O₅(OH)₄		CHEMICAL FORMULA (ACTUAL)																			
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:																	
ORIGIN OF SAMPLE Otway Prospect, W. AUSTRALIA	REMARKS		PARTICLE SIZE	CONC 4 mg																	
			MAJOR ABSORPTION BANDS (cm⁻¹)																		
			<table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3648</td> <td>mw</td> </tr> <tr> <td></td> <td>A₂</td> <td>3440</td> <td>m</td> </tr> <tr> <td></td> <td>D₁</td> <td>960</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>657</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>425</td> <td>s</td> </tr> </table>		A	A ₁	3648	mw		A ₂	3440	m		D ₁	960	s	D	D ₂	657	ms	
A	A ₁	3648	mw																		
	A ₂	3440	m																		
	D ₁	960	s																		
D	D ₂	657	ms																		
	D ₃	425	s																		

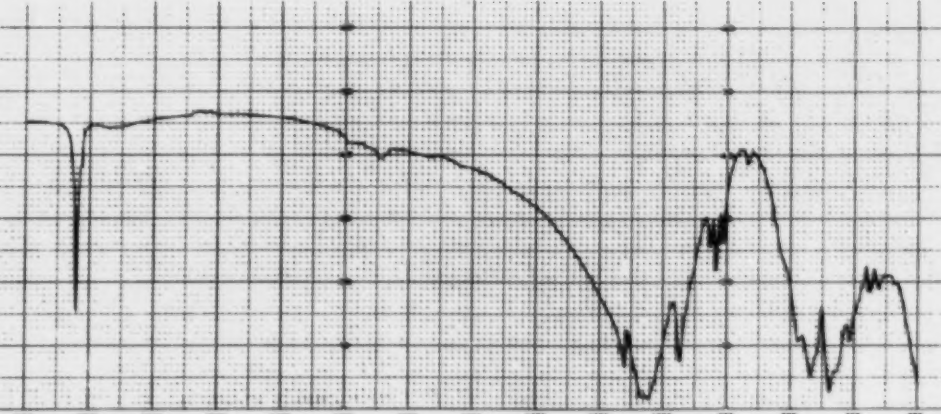
MINERAL NAME	SUB GROUP	GROUP	KAOLINITE-SERPENTINE	CLASS	PHYLLOSILICATES	SPECTRA NO	A283	
GREENALITE (1M or 1T)	DI-TRIOCTAHEDRAL	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
		(Fe ²⁺ , Fe ³⁺) ₂₋₃ Si ₂ O ₅ (OH) ₄						
CRYSTAL SYSTEM	SPACE GROUP	REMARKS				PARTICLE SIZE	CONC	
MONOCLINIC or TRIGONAL	Cc (1M) P31m (1T)	a: ~5.60Å b: ~9.70Å c: ~7.44Å α: β: ~104.2° γ:				Z:	D:	
ORIGIN OF SAMPLE	GSC 14782				For 1T, a=b~5.60, c~7.21Å α~β=90° =120°			
						MAJOR ABSORPTION BANDS (cm⁻¹)		
A						A ₁	3625	mw
						A ₂	3580	mw
						D ₁	1000	s
D						D ₂	651	m
						D ₃	455	ms
							325	ms

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CRONSTEDTITE	TRIOCTAHEDRAL	KAOLINITE-SERPENTINE	PHYLLOSILICATES	A250
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
(Fe ²⁺ ₂ , Fe ³⁺)(SiFe ³⁺)O ₅ (OH) ₄				
CRYSTAL SYSTEM	SPACE GROUP	REMARKS		
MONOCLINIC	Cm (8)	a: 5.49 b: 9.51 c: 7.32 α: β: 104° 31' γ: Z: 2 D: 3.586		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
Kutna Hora, CZECHOSLOVAKIA				1.5 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			A	A ₂ 3480 ms
				A ₃ 3230 ms
				D ₁ 953 s
D	D ₂ 670 ms			
	560 ms			
	D ₃ 460 s			
	332 s			

MINERAL NAME CHLORITOID	SUB GROUP	GROUP	CLASS PHYLOSILICATES	SPECTRA NO A292																																					
CHEMICAL FORMULA (IDEAL) (Fe,Mn)₂Al₄Si₂O₁₀(OH)₄		CHEMICAL FORMULA (ACTUAL)																																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/C (15)	a: 9.483 b: 5.687 c: 18.187 α: β: 101°55' γ:		Z: 4 D: 3.60																																					
ORIGIN OF SAMPLE GSC 01604	REMARKS		PARTICLE SIZE	CONC. 2 mg																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																						
			<table border="0"> <tr><td>A</td><td>A₂</td><td>3460</td><td>ms</td></tr> <tr><td>B</td><td>B₁</td><td>2975</td><td>ms</td></tr> <tr><td></td><td></td><td>1100</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>900</td><td>s</td></tr> <tr><td></td><td></td><td>795</td><td>ms</td></tr> <tr><td>D</td><td></td><td>740</td><td>s</td></tr> <tr><td></td><td>D₂</td><td>660</td><td>ms</td></tr> <tr><td></td><td></td><td>600</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>440</td><td>s</td></tr> <tr><td></td><td></td><td>311</td><td>ms</td></tr> </table>		A	A ₂	3460	ms	B	B ₁	2975	ms			1100	ms		D ₁	900	s			795	ms	D		740	s		D ₂	660	ms			600	ms		D ₃	440	s	
A	A ₂	3460	ms																																						
B	B ₁	2975	ms																																						
		1100	ms																																						
	D ₁	900	s																																						
		795	ms																																						
D		740	s																																						
	D ₂	660	ms																																						
		600	ms																																						
	D ₃	440	s																																						
		311	ms																																						

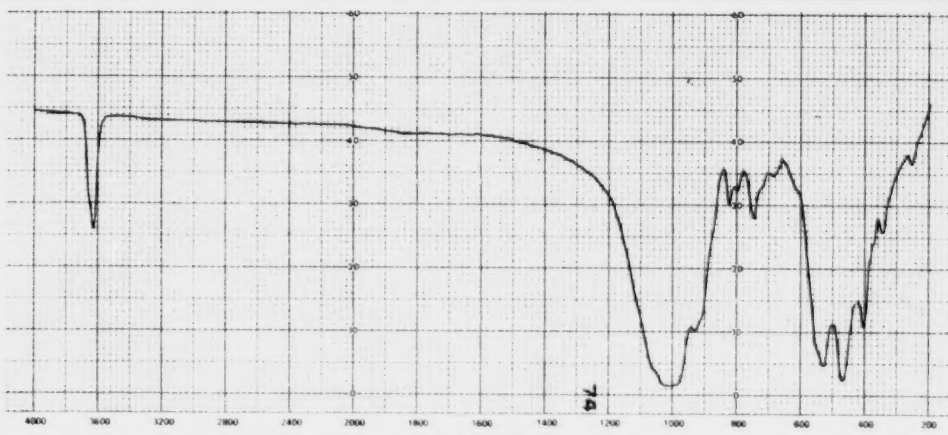
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: b: c: α: β: γ:		Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

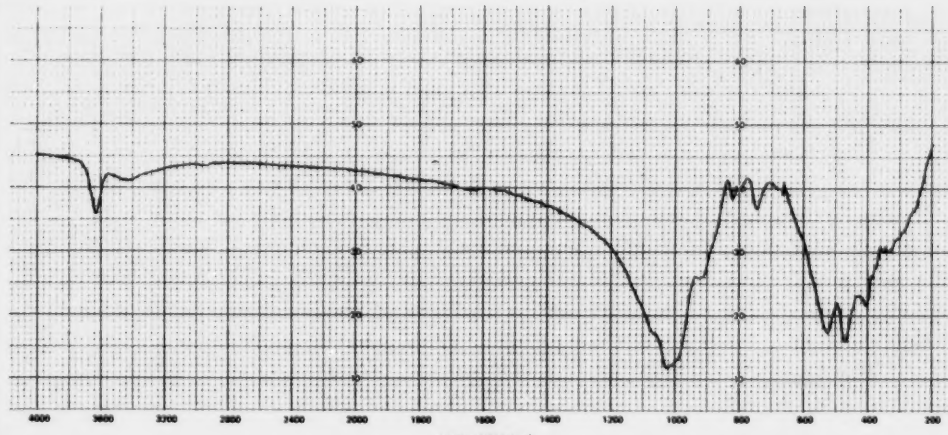
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRUM
PYROPHYLLITE (1Tc)	DIOCTAHEDRAL	TALC-PYROPHYLLITE	PHYLLOSILICATES	348
1-Layer TRICLINIC	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP			
TRICLINIC	$C\bar{1}$ (2)	a: 5.161 α : 91.03°	b: 8.958 β : 100.37°	c: 9.351 γ : 89.75°
		Z: 2	D: 2.883	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
				0.5 mg
			MAJOR ABSORPTION BANDS	
			(cm⁻¹)	
			A	A ₁ 3683 m
				1120 s
				1067 s
			D ₁	1049 s
				949 ms
				850 w
			D ₂	831 mw
				809 w
				570 ms
				538 s
				519 ms
				481 s
			D ₃	460 s
				414 mw
				392 mw
				365
				351 mw

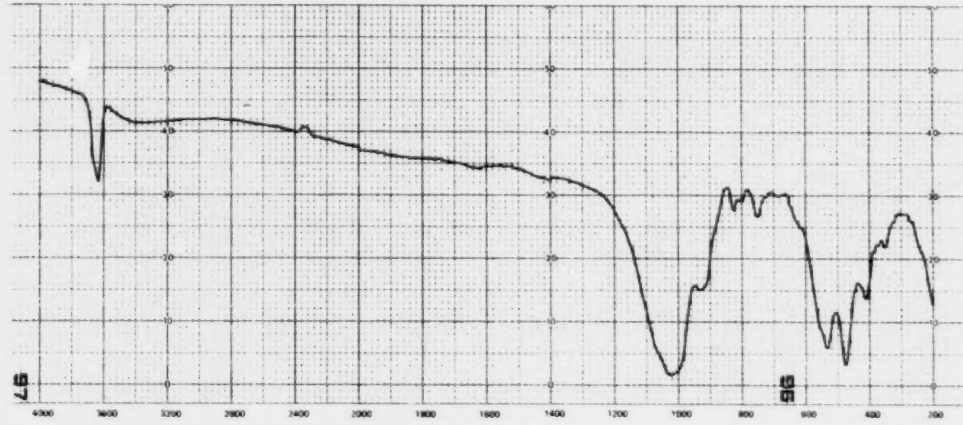
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRANO	
PYROPHYLLITE (2M)	DIOCTAHEDRAL	TALC-PYROPHYLLITE	PHYLLOSILICATES	Al90	
CHEMICAL FORMULA IDEAL		CHEMICAL FORMULA ACTUAL			
Al ₂ Si ₄ O ₁₀ (OH) ₂		Al _{2.02} (Si _{3.97} Al _{0.03})O ₁₀ (OH) ₂ (EDXRA)			
CRYSTAL SYSTEM	SPACE GROUP				
MONOCLINIC	Cc (9) a: 5.172 b: 8.958 c: 18.67 α: β: 100° γ: Z: 4 D: 2.883				
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC	
Zermatt, SWITZERLAND				2 mg	
			MAJOR ABSORPTION BANDS (cm ⁻¹)		
			A	A ₁	3683
				1120	s
				1066	s
			D ₁	1046	s
				947	s
				850	m
			D ₂	831	ms
				810	m
			D	572	s
				535	s
				517	s
				478	s
				457	s
			D ₃	413	s
				349	ms
				320	ms

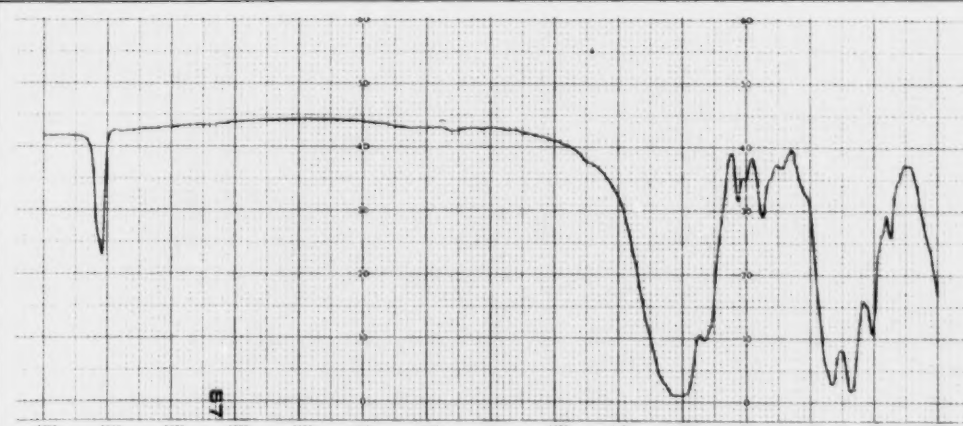
MINERAL NAME TALC	SUB GROUP TRIOCTAHEDRAL	GROUP TALC-PYROPHYLLITE	CLASS PHYLLOSILICATES	SPECTRA NO A191																													
CHEMICAL FORMULA (IDEAL) $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$		CHEMICAL FORMULA (ACTUAL)																															
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP $\bar{C}1$ (2)	a: 5.293 α : 90.57°	b: 9.179 β : 98.91°	c: 9.496 γ : 90.03° Z: 2 D: 2.824																													
ORIGIN OF SAMPLE Ogushi, Nagasaki, JAPAN	REMARKS		PARTICLE SIZE	CONC 2 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3690</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>3672</td> <td>w</td> </tr> <tr> <td rowspan="5">D</td> <td>D₁</td> <td>1020</td> <td>s</td> </tr> <tr> <td>D₂</td> <td>666</td> <td>s</td> </tr> <tr> <td></td> <td>529</td> <td>ms</td> </tr> <tr> <td></td> <td>461</td> <td></td> </tr> <tr> <td>D₃</td> <td>445</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>418</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>387</td> <td>s</td> </tr> </table>		A	A ₁	3690	mw			3672	w	D	D ₁	1020	s	D ₂	666	s		529	ms		461		D ₃	445	s			418	s	
A	A ₁	3690	mw																														
		3672	w																														
D	D ₁	1020	s																														
	D ₂	666	s																														
		529	ms																														
		461																															
	D ₃	445	s																														
		418	s																														
		387	s																														

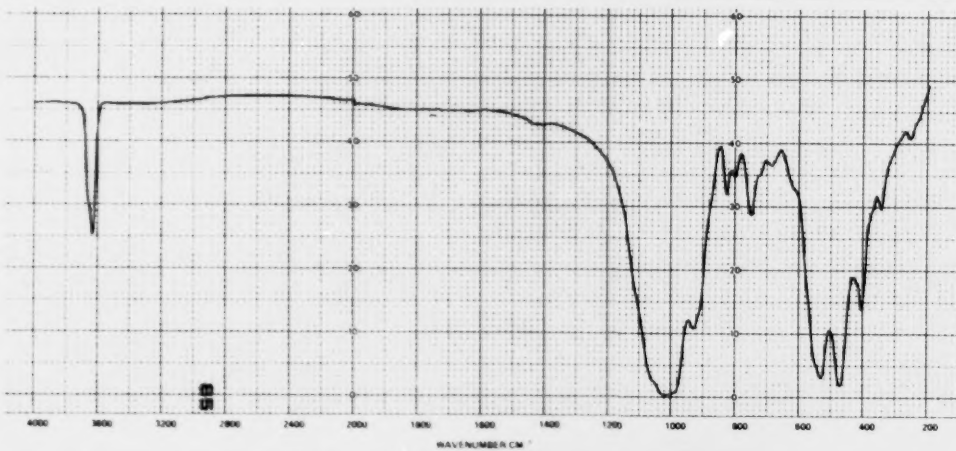
MINERAL NAME MINNESOTAITE	SUB GROUP TRIOCTAHEDRAL	GROUP PYROPHYLLITE	CLASS PHYLLOSILICATES	SPECTRA NO A282																					
CHEMICAL FORMULA (IDEAL) $(\text{Fe}, \text{Mg})_3\text{Si}_4\text{O}_{10}(\text{OH})_2$		CHEMICAL FORMULA (ACTUAL)																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.5 α :	b: 9.38 β : 99° 30'	c: 19.3 γ : Z: 4 D: 3.02																					
ORIGIN OF SAMPLE GSC 14027	REMARKS		PARTICLE SIZE	CONC 2 mg																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																						
			<table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3650</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1027</td> <td>s</td> </tr> <tr> <td rowspan="5">D</td> <td>D₂</td> <td>650</td> <td>m</td> </tr> <tr> <td></td> <td>600</td> <td>m</td> </tr> <tr> <td></td> <td>568</td> <td>m</td> </tr> <tr> <td>D₃</td> <td>451</td> <td>s</td> </tr> <tr> <td></td> <td>322</td> <td>ms</td> </tr> </table>		A	A ₁	3650	mw		D ₁	1027	s	D	D ₂	650	m		600	m		568	m	D ₃	451	s
A	A ₁	3650	mw																						
	D ₁	1027	s																						
D	D ₂	650	m																						
		600	m																						
		568	m																						
	D ₃	451	s																						
		322	ms																						

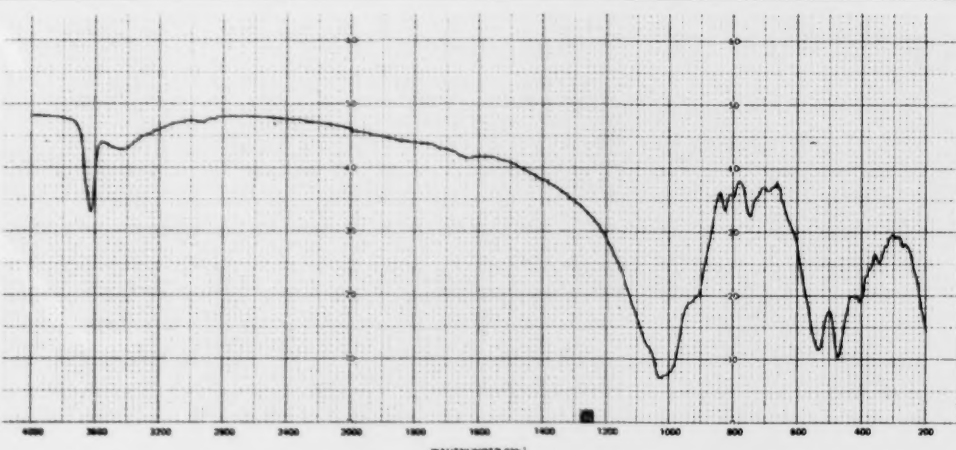
MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO
MUSCOVITE (2M ₁)	DIOCTATEDRAL	MICAS	PHYLLOSILICATES	371
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
KA1 ₂ [Si ₃ Al]O ₁₀ (OH) ₂		(K _{0.84} Na _{0.06})(Al _{1.92} Fe ³⁺ _{0.07} Mg _{0.04})(Si _{3.06} Al _{0.94})O ₁₀ (OH) ₂		
CRYSTAL SYSTEM	SPACE GROUP	a: 5.189 α:	b: 8.995 β: 95.18°	c: 20.097 γ: Z: 4 D: 2.843
MONOCLINIC	C2/c (15)			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE CONC
Nasu Mine, Tochigi, JAPAN				1 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				A A ₁ 3642 m
				D ₁ 1015 s
				930 s
				836 mw
				800 mw
				D ₂ 748 mw
				530 s
				470 s
				D ₃ 406 s
				347 m

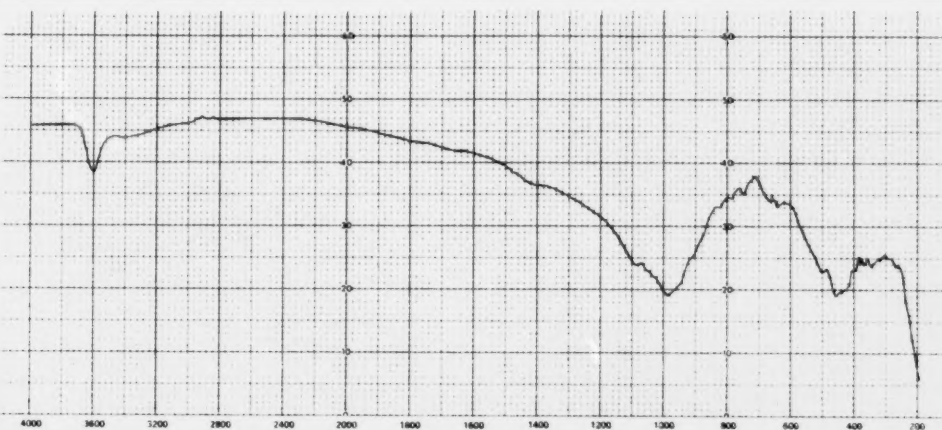
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
MUSCOVITE (2M ₁)	DIOCTAHEDRAL	MICAS	PHYLLOSILICATES	370		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
KAl ₂ [Si ₃ Al]O ₁₀ (OH) ₂		K _{0.8} (Al _{1.7} Fe _{0.4})(Si _{3.1} Al _{0.9})O ₁₀ (OH) ₂ (EDXRA)				
CRYSTAL SYSTEM	SPACE GROUP	a: 5.189 α:	b: 8.995 β: 95.18°	c: 20.097 γ: Z: 4 D: 2.843		
MONOCLINIC	C2/c (15)					
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
Effingham Twp., Ontario, CANADA				1 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₁	3628	mw
					1035	s
				D ₁	1011	sh
					920	sh m
		821	mw			
	D ₂	800	sh w			
		745	mw			
		525	ms			
	D ₃	471	ms			
		407	ms			

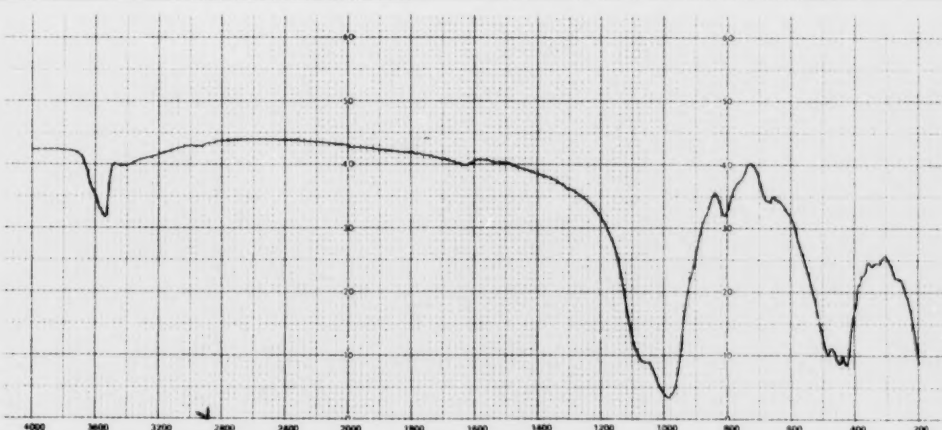
MUSCOVITE 1M	DIOCTAHEDRAL	GROUP	CLASS	SPECTRA NO		
		MICA	PHYLLOSILICATES	A412		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
KAl ₂ (Si ₃ Al)O ₁₀ (OH) ₂						
CRYSTAL SYSTEM	SPACE GROUP					
MONOCLINIC	()	a: 5.208 α:	b: 8.995 β: 101°36'	c: 10.275 γ:		
		Z: 2	D:			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
Matsumae, JAPAN			PURIFIED ~ < 1 μm	1 mg		
			MAJOR ABSORPTION BANDS (cm⁻¹)			
			A	A ₁	3630	m
					1015	s
			D ₁		952	sh ms
					823	) mw
			D ₂		800	w
					752	) mw
			D		535	s
					475	s
			D ₃		410	ms
					352	m

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
MUSCOVITE (2M ₁ +1M)	DIOCTAHEDRAL	MICAS	PHYLLOSILICATES	376			
(2M ₁ >1M)	CHEMICAL FORMULA (IDEAL) KAl ₂ [Si ₃ Al]O ₁₀ (OH) ₂		CHEMICAL FORMULA (ACTUAL)				
CRYSTAL SYSTEM	SPACE GROUP						
	()	a:	b:	c:			
		α:	β:	γ:			
				Z:			
				D:			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Miyori, Tochigi, JAPAN				2-5 μm			
				CONC			
				1 mg			
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
				A	A ₁	3640	m
						1010	s
					D ₁	930	s
						825	mw
					D ₂	800	mw
						749	mw
					D	529	s
						470	s
					D ₃	406	s
						347	m

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
MUSCOVITE (2M ₂)	DIOCTAHEDRAL	MICAS	PHYLLOSILICATES	362		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
KAl ₂ [Si ₃ Al]O ₁₀ (OH) ₂						
CRYSTAL SYSTEM	SPACE GROUP					
MONOCLINIC	()	a: 9.017 α:	b: 5.210 β: 100°24'	c: 20.437 γ: Z: D:		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
Tsuchihashi Mine, JAPAN				1 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₁	3640	m
					1019	s
			D ₁		930	s
					828	mw
	D ₂	800	mw			
		750	mw			
	D	533	s			
		476	s			
	D ₃	408	ms			
		347	mw			

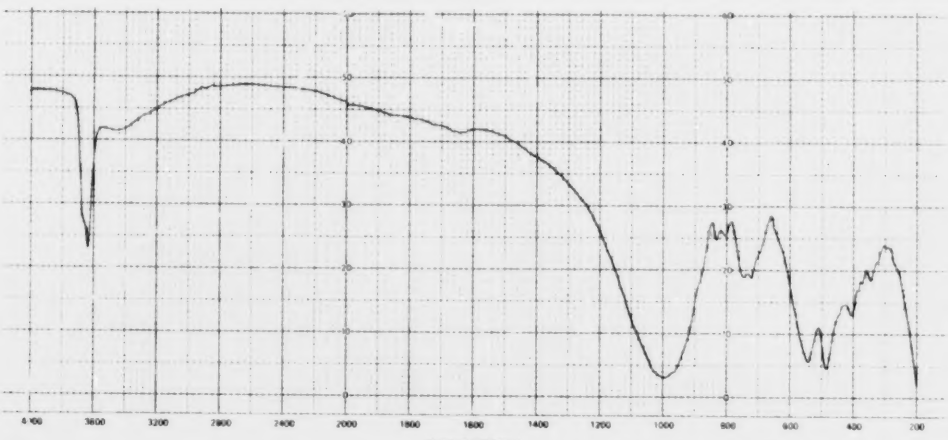
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
MUSCOVITE (3T)	DIOCTAHEDRAL	MICAS	PHYLLOSILICATES	A266		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
KAl ₂ [Si ₃ Al]O ₁₀ (OH) ₂						
CRYSTAL SYSTEM	SPACE GROUP	a: 5.203 α:	b: β:	c: 29.988 γ:		
TRIGONAL	P3 ₁ 12(151)			Z: 3 D: 2.821		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC		
From Dr. Guven				1 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₁	3639	mw
				D ₁	1028	s
					938	sh ms
					825	mw
	D ₂	798	mw			
		747	mw			
D		532	s			
		462	s			
	D ₃	405	ms			
		344	m			

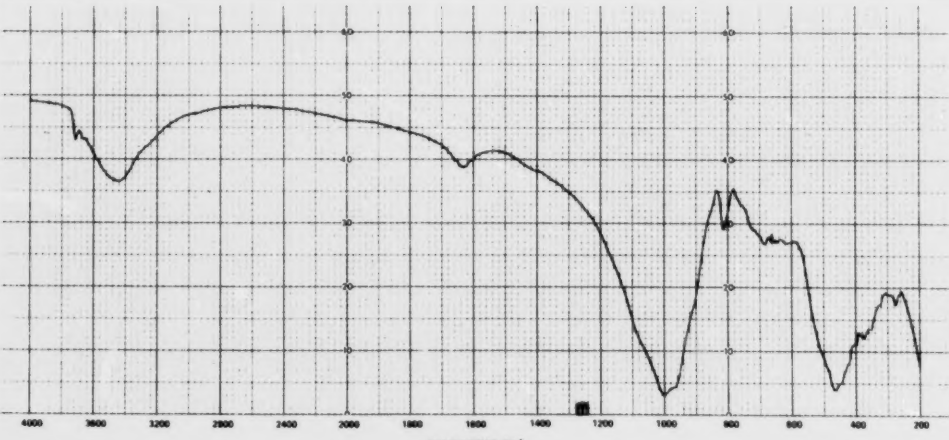
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
PHENGITE (1M)	DIOCTAHEDRAL	MICAS	PHYLOSILICATES	A200
CHEMICAL FORMULA (IDEAL)		R: Mg, Fe ⁺²		CHEMICAL FORMULA (ACTUAL)
K(Al _{1.5} R _{0.5}) ⁺² [Si _{3.5} Al _{0.5}]O ₁₀ (OH) ₂				
CRYSTAL SYSTEM	SPACE GROUP	a: ≈5.17 α:	b: ≈8.96 β: 101.33°	c: ≈10.25 γ: Z: 2 D:
MONOCLINIC	C2/m(12)			
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE CONC
Tiburon Peninsula, CALIFORNIA USA				2 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				A A ₁ 3610 w
				D ₁ 1083 m
				988 ms
				D ₂ 750 mw
				503 m
				D ₃ 458 ms
				442 ms

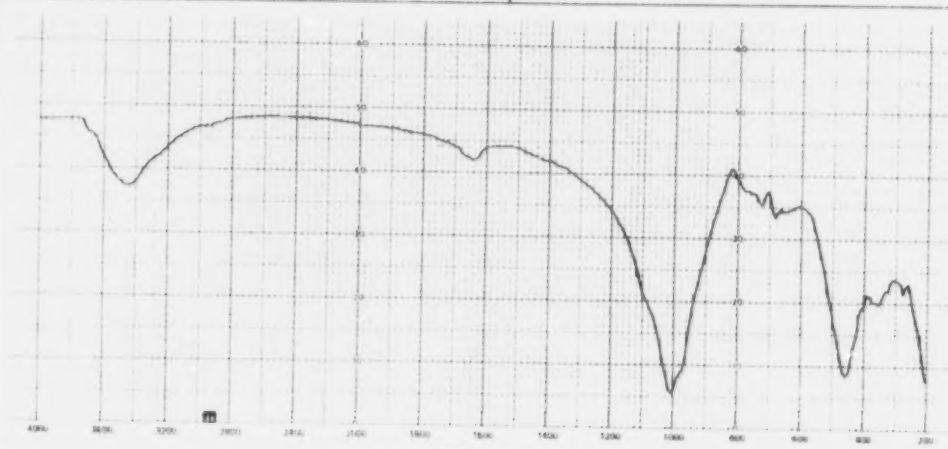
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
GLAUCONITE	DIOCTAHEDRAL	MICAS	PHYLOSILICATES	374
CHEMICAL FORMULA (IDEAL)			CHEMICAL FORMULA (ACTUAL)	
K(R ²⁺ R ³⁺)(Si _{4-x} Al _x)O ₁₀ (OH) ₂			x=0.17-0.43	
CRYSTAL SYSTEM	SPACE GROUP	a: 5.234 α:	b: 9.066 β: 100.5°	c: 10.16 γ: Z: 2 D: 2.903
MONOCLINIC ()				
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
Core Sample Bonnetterre,(USA)			<0.2 μm	1 mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	
			A A ₁ 3545 mw D ₁ 1060 sh s 987 s D ₂ 809 mw 670 mw D ₃ 486 s 450 s 428 s	

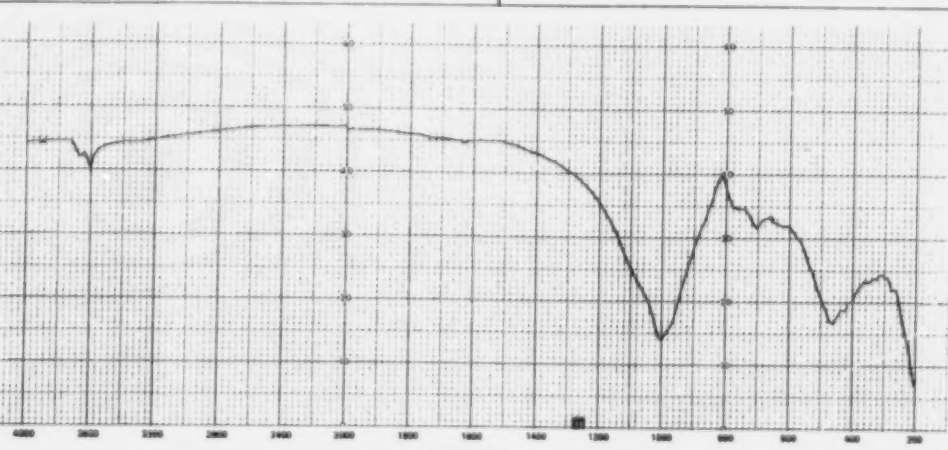
MINERAL NAME CHROMIAN MUSCOVITE	SUB GROUP DIOCTAHEDRAL	GROUP MICAS	CLASS PHYLLOSILICATES	SPECTRA NO A203																																
Cr-RICH MUSCOVITE FUCHITE		CHEMICAL FORMULA (IDEAL) $K(Cr,Al)_2[Si_3Al]O_{10}(OH)_2$	CHEMICAL FORMULA (ACTUAL)																																	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: α:	b: β:	c: γ:																																
ORIGIN OF SAMPLE Ouro Preto Minas Geras, BRAZIL		REMARKS		PARTICLE SIZE CONC 2 mg																																
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3595</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>1025</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>998</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>899</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>739</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>513</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>462</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>416</td> <td>s</td> </tr> </table>	A	A ₁	3595	mw			1025	s		D ₁	998	s			899	ms	D	D ₂	739	mw			513	s		D ₃	462	s			416	s
A	A ₁	3595	mw																																	
		1025	s																																	
	D ₁	998	s																																	
		899	ms																																	
D	D ₂	739	mw																																	
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	D ₃	462	s																																	
		416	s																																	

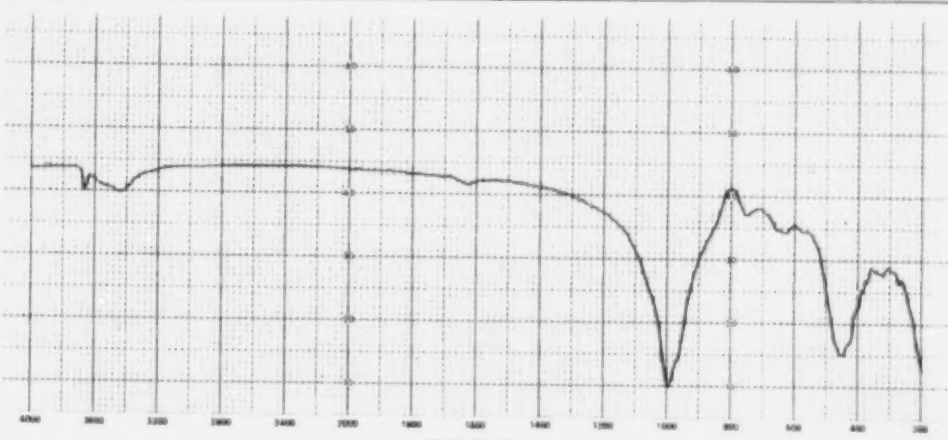
MINERAL NAME CHROMIAN PHENGITE	SUB GROUP DIOCTAHEDRAL	GROUP MICAS	CLASS PHYLLOSILICATES	SPECTRA NO A202																																								
ALURGITE		CHEMICAL FORMULA (IDEAL)	CHEMICAL FORMULA (ACTUAL)																																									
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: α:	b: β:	c: γ:																																								
ORIGIN OF SAMPLE St. Marcel, ITALY		REMARKS		PARTICLE SIZE CONC 2 mg																																								
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3623</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>1085</td> <td>s</td> </tr> <tr> <td></td> <td>D₁</td> <td>995</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>980</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>901</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>829</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>509</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>463</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>425</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>341</td> <td>ms</td> </tr> </table>	A	A ₁	3623	m			1085	s		D ₁	995	s			980	s			901	ms	D	D ₂	829	ms			509	s		D ₃	463	s			425	s			341	ms
A	A ₁	3623	m																																									
		1085	s																																									
	D ₁	995	s																																									
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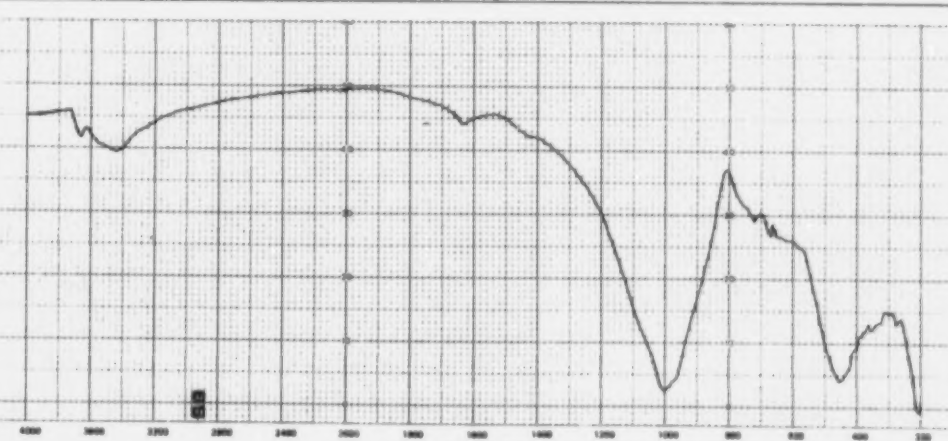
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
PARAGONITE (2M)	DIOCTAHEDRAL	MICAS	PHYLLOSILICATES	A198			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
NaAl ₂ [Si ₃ Al]O ₁₀ (OH) ₂							
CRYSTAL SYSTEM	SPACE GROUP	a: 5.152 α:	b: 8.88 β: 94°20'	c: 19.28 γ:	Z: 4	D: 2.886	
MONOCLINIC	C2/c (15)						
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE	CONC		
Kabozawa, Hyogo, JAPAN					2 mg		
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
				A	A ₁	3642	m
					D ₁	996	s
				D ₂		831	m
						801	m
						745	ms
						720	ms
				D		540	s
						483	s
				D ₃		404	ms
	344	ms					

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
PHLOGOPITE (1M)	TRIOCTAHEDRAL	MICAS	PHYLLOSILICATES	A264			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
KMG ₃ [Si ₃ Al]O ₁₀ (OH) ₂							
CRYSTAL SYSTEM	SPACE GROUP	a: 5.312 α:	b: 9.20 β: 99.82°	c: 10.204 γ:	Z: 2	D: 2.822	
MONOCLINIC	C2/m(12)						
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE	CONC		
Spence's Collection					2 mg		
				MAJOR ABSORPTION BANDS (cm⁻¹)			
				A	A ₁	3715	w
					A ₂	3440	mw
				B	B ₂	1653	w
					D ₁	998	s
				D	D ₂	812	mw
					D ₃	463	s

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.
BIOTITE (1M)	TRIOCTAHEDRAL	MICAS	PHYLLOSILICATES	360
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
$K(Fe,Mg)_3[Si_3Al]O_{10}(OH)_2$		$(K_{0.90}Na_{0.09})(Mg_{1.56}Fe^{2+}_{1.09}Fe^{3+}_{0.22}Mn_{0.07})^*$		
CRYSTAL SYSTEM	SPACE GROUP	a: 5.30	b: 9.21	c: 10.16
MONOCLINIC	C2/m(12)	$\alpha:$	$\beta: 99^\circ 3'$	$\gamma:$
Z: 2	D:			
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC.	
Bancroft, Ontario, CANADA	* $(Si_{2.93}Al_{1.02}Fe^{3+}_{0.05})O_{10}(OH)_2$	< 2 μm	1 mg	
				MAJOR ABSORPTION BANDS (cm ⁻¹)
A	A ₁	3440	mw	
B	B ₁	1635	w	
	D ₁	1000	s	
D	D ₂	719	mw	
	D ₃	678	mw	
	D ₄	460	s	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.
BIOTITE	TRIOCTAHEDRAL	MICAS	PHYLLOSILICATES	375
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
$K(Fe,Mg)_3[Si_3Al]O_{10}(OH)_2$		$(K_{0.94}Na_{0.04}Rb_{0.005}Ca_{0.003})(Fe^{2+}_{1.37}Mg_{0.70}Al_{0.62}Fe^{3+}_{0.08}Mn_{0.02})^*$		
CRYSTAL SYSTEM	SPACE GROUP	a: 5.30	b: 9.21	c: 10.16
MONOCLINIC	C2/m(12)	$\alpha:$	$\beta: 99^\circ 3'$	$\gamma:$
Z: 2	D:			
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC.	
ROM 2270	* $(Si_{2.73}Al_{1.27})O_{10}(OH)_2$		1 mg	
				MAJOR ABSORPTION BANDS (cm ⁻¹)
A	A ₁	3665	w	
	A ₁	3602	w	
	D ₁	997	ms	
D	D ₂	700	mw	
	D ₃	459	ms	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																					
ANNITE	TRIOCTAHEDRAL	MICAS	PHYLLOSILICATES	355																					
1M or 3T	CHEMICAL FORMULA (IDEAL) $\text{KFe}_3^{2+}(\text{AlSi}_3)\text{O}_{10}(\text{OH})_2$		CHEMICAL FORMULA (ACTUAL)																						
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 5.39 α:	b: 9.334 β: 100°00'	c: 10.290 γ: Z: 2 D: 3.334																					
ORIGIN OF SAMPLE Synthetic	REMARKS		PARTICLE SIZE	CONC. 1 mg																					
			MAJOR ABSORPTION BANDS (cm ⁻¹)																						
			<table><tr><td>A</td><td>A₂</td><td>3668</td><td>W</td></tr><tr><td></td><td>A₂</td><td>3440</td><td>W</td></tr><tr><td></td><td>D₁</td><td>997</td><td>S</td></tr><tr><td>D</td><td>D₂</td><td>745</td><td>mw</td></tr><tr><td></td><td></td><td>625</td><td>mw</td></tr><tr><td></td><td>D₃</td><td>450</td><td>ms</td></tr></table>		A	A ₂	3668	W		A ₂	3440	W		D ₁	997	S	D	D ₂	745	mw			625	mw	
A	A ₂	3668	W																						
	A ₂	3440	W																						
	D ₁	997	S																						
D	D ₂	745	mw																						
		625	mw																						
	D ₃	450	ms																						

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																	
LEPIDOMELANE	TRIOCTAHEDRAL	MICAS	PHYLLOSILICATES	A261																	
FERRIAN BIOTITE	CHEMICAL FORMULA (IDEAL) $K(Fe^{2+}, Mg, Fe^{3+})_3[Si_3Al]O_{10}(OH)_2$		CHEMICAL FORMULA (ACTUAL)																		
CRYSTAL SYSTEM	SPACE GROUP																				
	()	a: α:	b: β:	c: γ: Z: D:																	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																	
Ontario, CANADA				2 mg																	
			MAJOR ABSORPTION BANDS (cm ⁻¹)																		
			<table><tr><td>A</td><td>A₁</td><td>3680</td><td>W</td></tr><tr><td></td><td>A₂</td><td>3440</td><td>W</td></tr><tr><td></td><td>D₁</td><td>998</td><td>S</td></tr><tr><td>D</td><td>D₂</td><td>716</td><td>mw</td></tr><tr><td></td><td>D₃</td><td>446</td><td>S</td></tr></table>		A	A ₁	3680	W		A ₂	3440	W		D ₁	998	S	D	D ₂	716	mw	
A	A ₁	3680	W																		
	A ₂	3440	W																		
	D ₁	998	S																		
D	D ₂	716	mw																		
	D ₃	446	S																		

MINERAL NAME LEPIDOLITE	SUB GROUP TRIOCTAHEDRAL	GROUP MICAS	CLASS PHYLLOSILICATES	SPECTRA NO 377																								
CHEMICAL FORMULA (IDEAL) $K(Li,Al)_3(Si_3Al)O_{10}(OH,F)_2$		CHEMICAL FORMULA (ACTUAL)																										
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $C2/m (12)$	a: 5.212 $\alpha:$	b: 9.005 $\beta: 100.5^\circ$	c: 10.129 $\gamma:$																								
ORIGIN OF SAMPLE Nagatareyama, Fukuoka, JAPAN		REMARKS	PARTICLE SIZE	CONC 1 mg																								
			MAJOR ABSORPTION BANDS (cm^{-1})																									
			<table> <tr><td></td><td>1090</td><td>ms</td></tr> <tr><td></td><td>1012</td><td>ms</td></tr> <tr><td>D₁</td><td>995</td><td>ms</td></tr> <tr><td></td><td>965</td><td>ms</td></tr> <tr><td>D</td><td>791</td><td>mw</td></tr> <tr><td>D₂</td><td>748</td><td>mw</td></tr> <tr><td></td><td>523</td><td>ms</td></tr> <tr><td>D₃</td><td>472</td><td>ms</td></tr> <tr><td></td><td>438</td><td>ms</td></tr> </table>			1090	ms		1012	ms	D ₁	995	ms		965	ms	D	791	mw	D ₂	748	mw		523	ms	D ₃	472	ms
	1090	ms																										
	1012	ms																										
D ₁	995	ms																										
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D ₂	748	mw																										
	523	ms																										
D ₃	472	ms																										
	438	ms																										

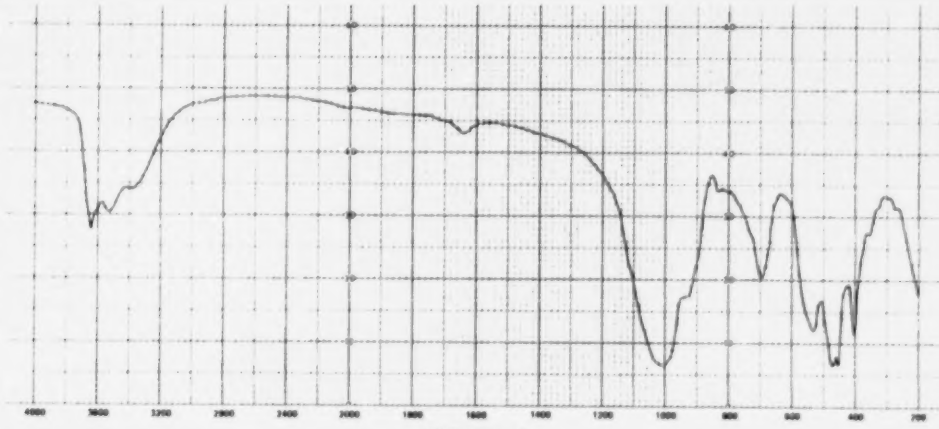
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	$\alpha:$	$\beta:$	$\gamma:$
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

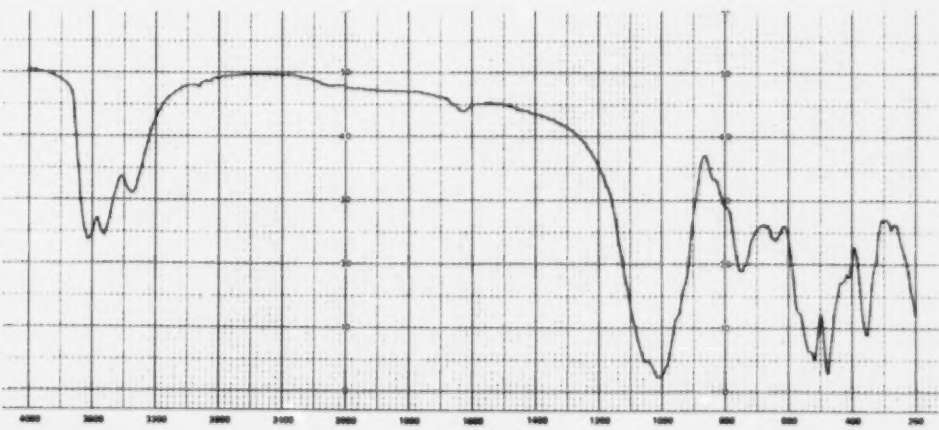
MINERAL NAME		SUB GROUP		GROUP		CLASS		SPECTRA NO			
CLINTONITE (1M)		TRIOCTAHEDRAL		BRITTLE MICAS		PHYLLOSILICATES		A151			
CHEMICAL FORMULA (IDEAL)				CHEMICAL FORMULA (ACTUAL)							
Ca(Mg ₂ Al)(SiAl ₃)O ₁₀ (OH) ₂											
CRYSTAL SYSTEM		SPACE GROUP		a: 5.204		b: 9.026		c: 9.812			
MONOCLINIC		C2/m (12)		α:		β:		γ:			
ORIGIN OF SAMPLE				REMARKS				PARTICLE SIZE			
Edenville, NEW YORK, USA								2 mg			
								MAJOR ABSORPTION BANDS (cm ⁻¹)			
								A		3625	mw
										3415	mw
										950	
								D ₁		925)	s
		900									
D		809	s								
D ₂		665	s								
		481)									
D ₃		466	s								

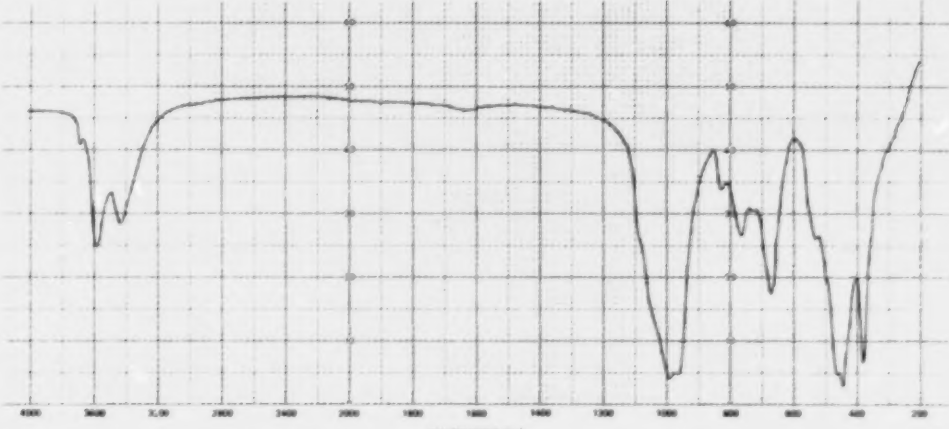
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																	
MARGARITE (2M ₁)	DIOCTAHEDRAL	BRITTLE MICAS	PHYLLOSILICATES	413																																	
CHEMICAL FORMULA (IDEAL)			CHEMICAL FORMULA (ACTUAL)																																		
CaAl ₂ (Si ₄ Al ₂)O ₁₀ (OH) ₂																																					
CRYSTAL SYSTEM	SPACE GROUP	a: 5.18 β: 95.09° γ:	b: 8.799 c: 19.159 Z: 4	D: 3.077																																	
MONOCLINIC	Cc (9)																																				
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC																																	
Chester, MASSACHUSETTS, USA				2 mg																																	
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																		
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3643</td> <td>m</td> </tr> <tr> <td></td> <td>A₂</td> <td>3440</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>980</td> <td></td> </tr> <tr> <td></td> <td>D₁</td> <td>925)</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>695</td> <td></td> </tr> <tr> <td>D</td> <td>D₂</td> <td>540</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>490</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>395)</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>383</td> <td>ms</td> </tr> </table>		A	A ₁	3643	m		A ₂	3440	mw			980			D ₁	925)	s			695		D	D ₂	540	ms			490	s		D ₃	395)	s	
A	A ₁	3643	m																																		
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	D ₁	925)	s																																		
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D	D ₂	540	ms																																		
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	D ₃	395)	s																																		
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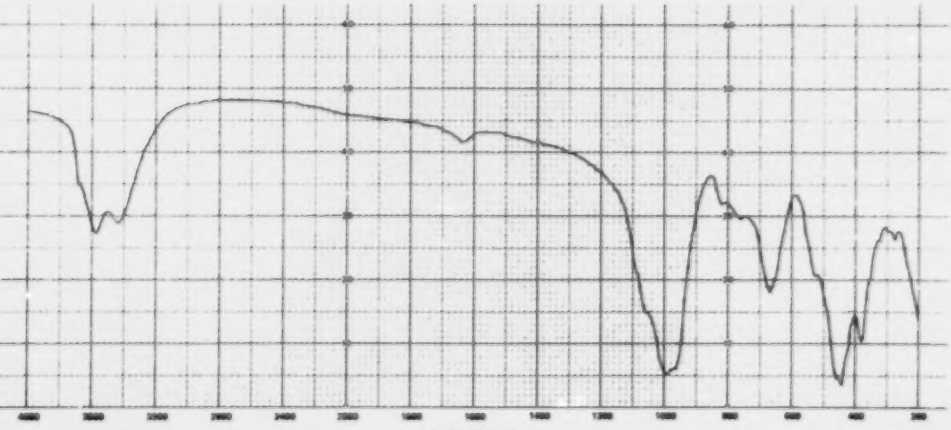
MINERAL NAME EPHESITE	SUB GROUP TRIOCTAHEDRAL	GROUP BRITTLE MICAS	CLASS PHYLLOSILICATES	SPECTRA NO A288																																																					
CHEMICAL FORMULA (IDEAL) $\text{NaLiAl}_2(\text{Al}_2\text{Si}_2)\text{O}_{10}(\text{OH})_2$		CHEMICAL FORMULA (ACTUAL)																																																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.1 α:	b: 8.9 β: 95°	c: 19.3 γ: Z: 4 D: 3.08																																																					
ORIGIN OF SAMPLE GSC 63154	REMARKS		PARTICLE SIZE	CONC 2 mg																																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																						
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3621</td><td>S</td></tr> <tr><td></td><td>A₂</td><td>3440</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>970</td><td>S</td></tr> <tr><td></td><td></td><td>910</td><td>S</td></tr> <tr><td></td><td>D₂</td><td>827</td><td>ms</td></tr> <tr><td></td><td></td><td>716</td><td>S</td></tr> <tr><td></td><td></td><td>581</td><td>S</td></tr> <tr><td></td><td>D</td><td>528</td><td></td></tr> <tr><td></td><td></td><td>505</td><td>S</td></tr> <tr><td></td><td>D₃</td><td>491</td><td></td></tr> <tr><td></td><td></td><td>459</td><td>S</td></tr> <tr><td></td><td></td><td>438</td><td>S</td></tr> <tr><td></td><td></td><td>404</td><td>S</td></tr> <tr><td></td><td></td><td>379</td><td>S</td></tr> </table>		A	A ₁	3621	S		A ₂	3440	mw		D ₁	970	S			910	S		D ₂	827	ms			716	S			581	S		D	528				505	S		D ₃	491				459	S			438	S			404	S	
A	A ₁	3621	S																																																						
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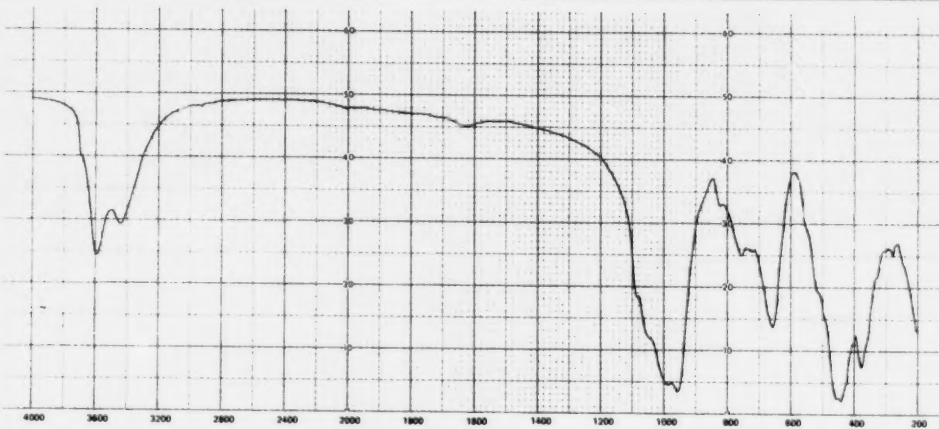
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α:	β:	γ:
				Z:
				D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

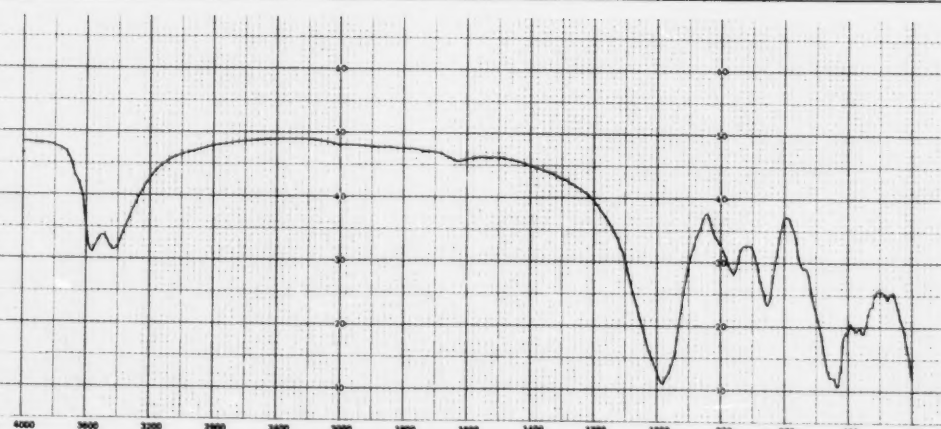
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
SUDOITE	DI-TRIOCTAHEDRAL	CHLORITE	PHYLLOSILICATES	181
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
(Al,Mg,Fe) ₄₋₅ [Si ₃ Al] ₁₀ (OH) ₈		(Al _{3.02} Mg _{1.18} Fe ³⁺ _{0.33} Ca _{0.11} Fe ²⁺ _{0.03})(Si _{3.26} Al _{0.74}) ₁₀ (OH) ₈		
CRYSTAL SYSTEM	SPACE GROUP	a: 5.237 α:	b: 9.070 β: 97°02'	c: 14.285 γ: Z: 2 D: 2.653
MONOCLINIC	C2/m(?) (12)			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC
Kamikita Mine, Aomori, JAPAN				0.7 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			A ₁	3635 m
			A ₂	3515 mw
			A ₃	3385 mw
D	D ₁	1000 s		
	D ₂	930 ms		
		690 ms		
		530 s		
		467 s		
	D ₃	450 s		
		400 s		

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO	
COOKEITE	DIOCTAHEDRAL	CHLORITE	PHYLLOSILICATES	174	
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)			
(Li Al ₄)[Si ₃ Al]O ₁₀ (OH) ₈					
CRYSTAL SYSTEM	SPACE GROUP	a: 5.18 α:	b: 8.96 β: 98°45'	c: 14.30 γ: Z: 2 D: 2.67	
MONOCLINIC	P2 ₁ /a (14)				
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC	
North Little Rock, ARKANSAS, USA				0.7 mg	
			MAJOR ABSORPTION BANDS (cm ⁻¹)		
			A ₁	3625	m
			A ₂	3525	m
			A ₃	3350	mw
			D ₁	1008	s
D	D ₂	747	ms		
		636	m		
		518	s		
	D ₃	475	s		
		350	s		

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																			
CLINOCHLORE	TRIOCTAHEDRAL	CHLORITES	PHYLLOSILICATES	185																																			
(Iib STRUCTURE)	CHEMICAL FORMULA (IDEAL) $Mg_5Al[Si_3Al]O_{10}(OH)_8$		CHEMICAL FORMULA (ACTUAL) $(Mg_{4.94}Al_{0.71}Fe^{2+}_{0.54})(Si_{2.88}Al_{1.12})O_{10}(OH)_8$																																				
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12) (IDEAL)	a: 5.37 α:	b: 9.30 β: 97.0° γ:	c: 14.19 Z: 2 D: 2.668																																			
ORIGIN OF SAMPLE Fermatt Valais, SWITZERLAND		REMARKS		PARTICLE SIZE CONC 0.7 mg																																			
				MAJOR ABSORPTION BANDS (cm⁻¹)																																			
				<table><tr><td>A</td><td>A₁</td><td>3678</td><td>w</td></tr><tr><td></td><td>A₂</td><td>3575</td><td>m</td></tr><tr><td></td><td></td><td>3420</td><td>mw</td></tr><tr><td rowspan="2">D</td><td>D₁</td><td>982</td><td>s</td></tr><tr><td></td><td>960 /</td><td></td></tr><tr><td></td><td></td><td>758</td><td>m</td></tr><tr><td></td><td>D₂</td><td>664</td><td>ms</td></tr><tr><td></td><td></td><td>455</td><td>s</td></tr><tr><td></td><td>D₃</td><td>438</td><td>s</td></tr><tr><td></td><td></td><td>373</td><td>s</td></tr></table>	A	A ₁	3678	w		A ₂	3575	m			3420	mw	D	D ₁	982	s		960 /				758	m		D ₂	664	ms			455	s		D ₃	438	s
A	A ₁	3678	w																																				
	A ₂	3575	m																																				
		3420	mw																																				
D	D ₁	982	s																																				
		960 /																																					
		758	m																																				
	D ₂	664	ms																																				
		455	s																																				
	D ₃	438	s																																				
		373	s																																				

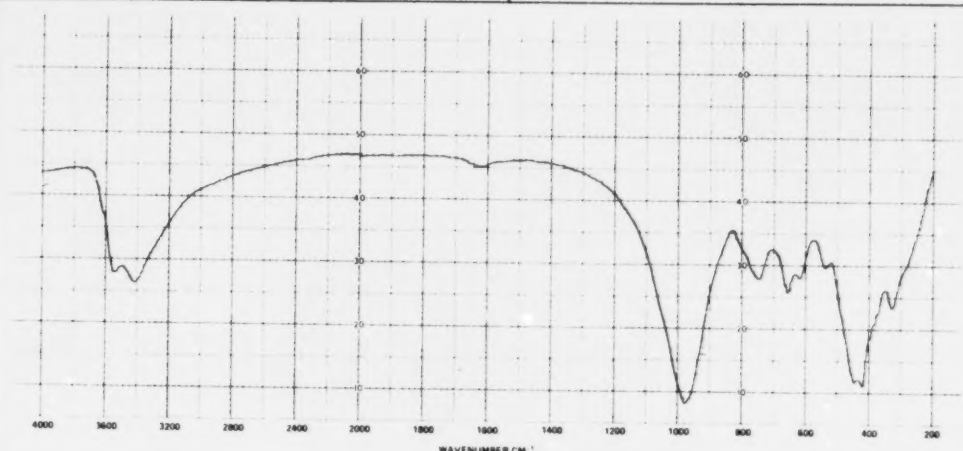
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CLINOCHLORE	TRIOCTAHEDRAL	CHLORITES	PHYLLOSILICATES	183
Iib-STRUCTURE	CHEMICAL FORMULA (IDEAL) (Mg ₅ Al)[Si ₃ Al]O ₁₀ (OH) ₈		CHEMICAL FORMULA (ACTUAL) (Mg _{4.30} Al _{1.28} Fe ²⁺ _{0.30} Fe ³⁺ _{0.06})(Si _{2.80} Al _{1.20})O ₁₀ (OH) ₈	
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 5.37 α:	b: 9.30 β: 97.0° γ:	c: 14.19 Z: 2 D: 2.668
ORIGIN OF SAMPLE Wanibuchi Mine, Shimane, JAPAN	REMARKS			PARTICLE SIZE CONC 0.7 mg
				MAJOR ABSORPTION BANDS (cm ⁻¹)
				A A ₁ 3575 m
				3440 mw
				D ₁ 990) s
				970)
D D ₂ 663 ms				
454)				
D ₃ 440) s				
378 s				

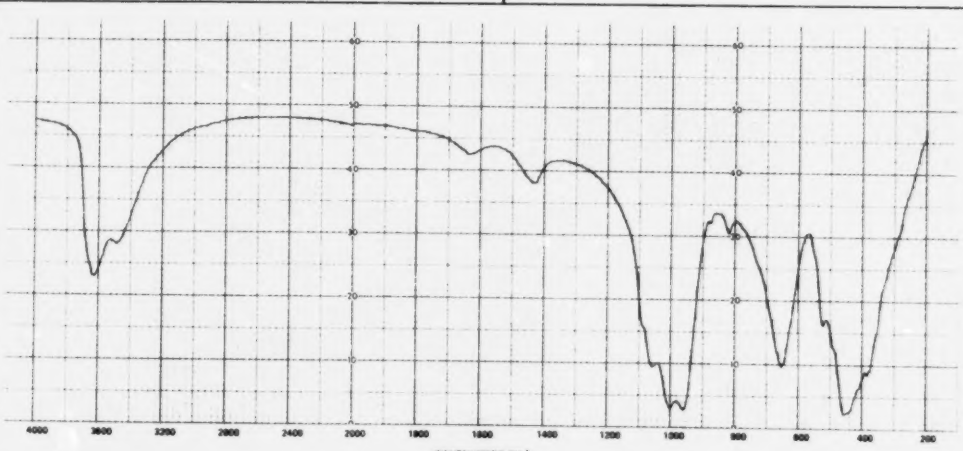
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																
Fe-CLINOCHLORE	TRIOCTAHEDRAL	CHLORITES	PHYLLOSILICATES	179																																
CHEMICAL FORMULA (IDEAL) (Mg, Fe) ₅ Al[Si ₃ Al] ₁₀ (OH) ₈		CHEMICAL FORMULA (ACTUAL) (Mg _{4.47} Al _{0.85} Fe ²⁺ _{0.72} Fe ³⁺ _{0.04})(Si _{2.93} Al _{1.07}) ₁₀ (OH) ₈																																		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m(?) 12)	a: 5.326 α:	b: 9.226 β: 97°10'	c: 14.127 γ: Z: 2 D: 2.700																																
ORIGIN OF SAMPLE Chester, VERMONT, USA	REMARKS			PARTICLE SIZE CONC 0.7 mg																																
				MAJOR ABSORPTION BANDS (cm ⁻¹)																																
				<table><tr><td>A</td><td>A₁</td><td>3580</td><td>m</td></tr><tr><td></td><td></td><td>3435</td><td>mw</td></tr><tr><td></td><td>D₁</td><td>980)</td><td>s</td></tr><tr><td></td><td></td><td>950)</td><td>s</td></tr><tr><td></td><td>D₂</td><td>750</td><td>m</td></tr><tr><td></td><td></td><td>650</td><td>ms</td></tr><tr><td>D</td><td></td><td>450)</td><td></td></tr><tr><td></td><td>D₃</td><td>437)</td><td>s</td></tr><tr><td></td><td></td><td>372</td><td>s</td></tr></table>	A	A ₁	3580	m			3435	mw		D ₁	980)	s			950)	s		D ₂	750	m			650	ms	D		450)			D ₃	437)	s
A	A ₁	3580	m																																	
		3435	mw																																	
	D ₁	980)	s																																	
		950)	s																																	
	D ₂	750	m																																	
		650	ms																																	
D		450)																																		
	D ₃	437)	s																																	
		372	s																																	

MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO
Fe-CLINOCHLORE	TRIOCTAHEDRAL	CHLORITES	PHYLLOSILICATES	184
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
(Mg,Fe) ₅ Al[Si ₃ Al] ₁₀ (OH) ₈		(Mg _{2.82} Fe ²⁺ _{1.24} Al _{1.17} Fe ³⁺ _{0.52} Ca _{0.09})(Si _{2.62} Al _{1.38}) ₁₀ (OH) ₈		
CRYSTAL SYSTEM	SPACE GROUP	a: 5.360	b: 9.283	c: 14.044
MONOCLINIC	C2/m(?))	α:	β: 97°15'	γ:
Z: 2		D: 2.899		
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
Hitachi, Ibaragi, JAPAN				CONC
				0.7 mg
				MAJOR ABSORPTION BANDS (cm⁻¹)
				A A ₁ 3560 mw
				3420 mw
				D ₁ 982 s
				D ₂ 755 mw
D 650 m				
D ₃ 450)				
431) s				

MINERAL NAME Cr-CLINOCLORE	SUB GROUP TRIOCTAHEDRAL	GROUP CHLORITES	CLASS PHYLLOSILICATES	SPECTRA NO 180																									
CHEMICAL FORMULA (IDEAL) (Mg₅)(Cr,Fe,Al)[Si₃Al]O₁₀(OH)₈		CHEMICAL FORMULA (ACTUAL)																											
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP C$\bar{1}$ (1)	a: 5.335 α: 90°	b: 9.240 β: 90°	c: 28.735 γ: 90°																									
ORIGIN OF SAMPLE Red Lodge Mine, CALIFORNIA USA		REMARKS	PARTICLE SIZE	CONC 0.7 mg																									
			MAJOR ABSORPTION BANDS (cm ⁻¹)																										
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3595</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>3440</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>995</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>952</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>642</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>450</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>440</td> <td>ms</td> </tr> </table>		A	A ₁	3595	mw			3440	mw		D ₁	995	ms			952	ms	D	D ₂	642	ms			450	ms	
A	A ₁	3595	mw																										
		3440	mw																										
	D ₁	995	ms																										
		952	ms																										
D	D ₂	642	ms																										
		450	ms																										
	D ₃	440	ms																										

MINERAL NAME Mg-CHAMOSITE	SUB GROUP TRIOCTAHEDRAL	GROUP CHLORITES	CLASS PHYLLOSILICATES	SPECTRA NO 188																																					
CHEMICAL FORMULA (IDEAL) (Fe,Mg)₅Al[Si₃Al]O₁₀(OH)₈		CHEMICAL FORMULA (ACTUAL) (Fe²⁺_{2.01}Al^{1.41}Fe³⁺_{1.04}Mg_{0.77}Mn_{0.09})(Si_{2.89}Al_{1.11})O₁₀(OH)₈																																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m(?) (12)	a: 5.372 α:	b: 9.305 β: 97°16'	c: 14.029 γ:																																					
ORIGIN OF SAMPLE Dona Ana Co., NEW MEXICO, USA		REMARKS	PARTICLE SIZE	CONC 0.7 mg																																					
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																						
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3550</td> <td>ms</td> </tr> <tr> <td></td> <td>A₂</td> <td>3410</td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>975</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>770</td> <td></td> </tr> <tr> <td></td> <td></td> <td>748</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>657</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>621</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>445</td> <td></td> </tr> <tr> <td></td> <td>D₃</td> <td>418</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>330</td> <td>ms</td> </tr> </table>		A	A ₁	3550	ms		A ₂	3410	ms		D ₁	975	s			770				748	ms	D	D ₂	657	ms			621	ms			445			D ₃	418	s	
A	A ₁	3550	ms																																						
	A ₂	3410	ms																																						
	D ₁	975	s																																						
		770																																							
		748	ms																																						
D	D ₂	657	ms																																						
		621	ms																																						
		445																																							
	D ₃	418	s																																						
		330	ms																																						

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
Mg-CHAMOSITE	TRIOCTAHEDRAL	CHLORITES	PHYLLOSILICATES	186			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
(Fe,Mg) ₅ Al[Si ₃ Al] ₀ O ₁₀ (OH) ₈		(Fe ²⁺ _{2.57} Al _{0.96} Fe ³⁺ _{0.95} Mn _{0.72} Mn _{0.54})(Si _{2.61} Al _{1.39}) ₀ O ₁₀ (OH) ₈					
CRYSTAL SYSTEM	SPACE GROUP	a: 5.372	b: 9.305	c: 14.029			
MONOCLINIC	C2/m(?) (12)	α:	β: 97°16'	γ:			
			Z: 2	D: 3.035			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Ichinokoshi, Toyama, JAPAN				CONC			
				0.7 mg			
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
				A	A ₁	3550	m
						3415	m
					D ₁	975	s
						745	mw
	D ₂	656	m				
D		616	mw				
		444					
	D ₃	419	s				
		326	m				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
Mn-CLINOCLORE	TRIOCTAHEDRAL	CHLORITES	PHYLLOSILICATES	187			
Mg-PENNANTITE	CHEMICAL FORMULA (IDEAL) (Mg,Mn,Fe) ₅ Al[Si ₃ Al] ₀ O ₁₀ (OH) ₈		CHEMICAL FORMULA (ACTUAL):				
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:			
MONOCLINIC	()	α:	β:	γ:			
			Z:	D:			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Langban, SWEDEN				CONC			
				0.7 mg			
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
				A	A ₁	3625	m
						3480	m
						998	s
					D ₁	956	s
D		D ₂	650	s			
		D ₃	455	s			

MINERAL NAME VERMICULITE	SUB GROUP	GROUP VERMICULITES	CLASS PHYLLOSILICATES	SPECTRA NO A187																	
LOW-LAYER CHARGE 0.54	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(\text{H}_2 2.16 \text{Fe}^{3+} 0.43 \text{Al}^{1+} 0.20 \text{Fe}^{2+} 0.04)(\text{Si} 2.82 \text{Al}^{1+} 1.17) \text{O}_{10}(\text{OH})_2 \cdot \text{H}^{+}_{0.54}$																		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP Cc(6)&C2/c (15)	a: ≈ 5.35 b: ≈ 9.25 c: $\approx nx14.45$ $\beta: \approx 97^{\circ}07'$ $\gamma:$ Z: D: 2.22																			
ORIGIN OF SAMPLE Prayssac, FRANCE	REMARKS a 5.349, b 9.255, c 28.772 $\beta 97^{\circ}07'$, Z: 4 with C2/c		PARTICLE SIZE	CONC 2 mg																	
			MAJOR ABSORPTION BANDS (cm^{-1})																		
			<table border="1"> <tr><td>A</td><td>A₂</td><td>3420</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>1000</td><td>ms</td></tr> <tr><td>D</td><td>D₂</td><td>650</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>450</td><td>ms</td></tr> </table>		A	A ₂	3420	ms	B	B ₂	1640	mw		D ₁	1000	ms	D	D ₂	650	ms	
A	A ₂	3420	ms																		
B	B ₂	1640	mw																		
	D ₁	1000	ms																		
D	D ₂	650	ms																		
	D ₃	450	ms																		

MINERAL NAME VERMICULITE	SUB GROUP	GROUP VERMICULITES	CLASS PHYLLOSILICATES	SPECTRA NO A188																	
HIGH-LAYER CHARGE 0.82	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(\text{H}_2 2.59 \text{Fe}^{3+} 0.24 \text{Ti}^{1+} 0.08 \text{Al}^{1+} 0.06 \text{Fe}^{3+} 0.03)(\text{Si} 2.72 \text{Al}^{1+} 1.28) \text{O}_{10}(\text{OH})_2 \cdot \text{H}^{+}_{0.82}$																		
CRYSTAL SYSTEM	SPACE GROUP ()	a: b: c: Z: D: $\alpha:$ $\beta:$ $\gamma:$																			
ORIGIN OF SAMPLE Santa Olalla, SPAIN	REMARKS		PARTICLE SIZE	CONC 2 mg																	
			MAJOR ABSORPTION BANDS (cm^{-1})																		
			<table border="1"> <tr><td>A</td><td>A₂</td><td>3425</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1645</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>995</td><td>s</td></tr> <tr><td>D</td><td>D₂</td><td>650</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>450</td><td>s</td></tr> </table>		A	A ₂	3425	s	B	B ₂	1645	ms		D ₁	995	s	D	D ₂	650	ms	
A	A ₂	3425	s																		
B	B ₂	1645	ms																		
	D ₁	995	s																		
D	D ₂	650	ms																		
	D ₃	450	s																		

MINERAL NAME VERMICULITE	SUB-GROUP	GROUP VERMICULITES	CLASS PHYLLOSILICATES	SPECTRA NO 351																				
CHEMICAL FORMULA (IDEAL) $\sim \text{Mg}_3(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2 \cdot \text{Mg}_{0.5}(\text{H}_2\text{O})_4$		CHEMICAL FORMULA (ACTUAL) $[\text{Ca}_{0.02}\text{Mg}_{0.28}](\text{Mg}_{2.54}\text{Fe}^{3+}_{0.40}\text{Fe}^{2+}_{0.08}\text{Ti}_{0.05})(\text{Si}_{2.76}\text{Al}_{1.24})\text{O}_{10}(\text{OH})_2$																						
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:																				
ORIGIN OF SAMPLE Kenya, AFRICA		REMARKS		PARTICLE SIZE CONC 1 mg																				
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr><td>A</td><td>A₁</td><td>3450</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>1000</td><td>s</td></tr> <tr><td>D</td><td>D₂</td><td>665</td><td>m</td></tr> <tr><td></td><td>D₃</td><td>452</td><td>s</td></tr> </table>	A	A ₁	3450	ms	B	B ₂	1640	mw		D ₁	1000	s	D	D ₂	665	m		D ₃	452	s
A	A ₁	3450	ms																					
B	B ₂	1640	mw																					
	D ₁	1000	s																					
D	D ₂	665	m																					
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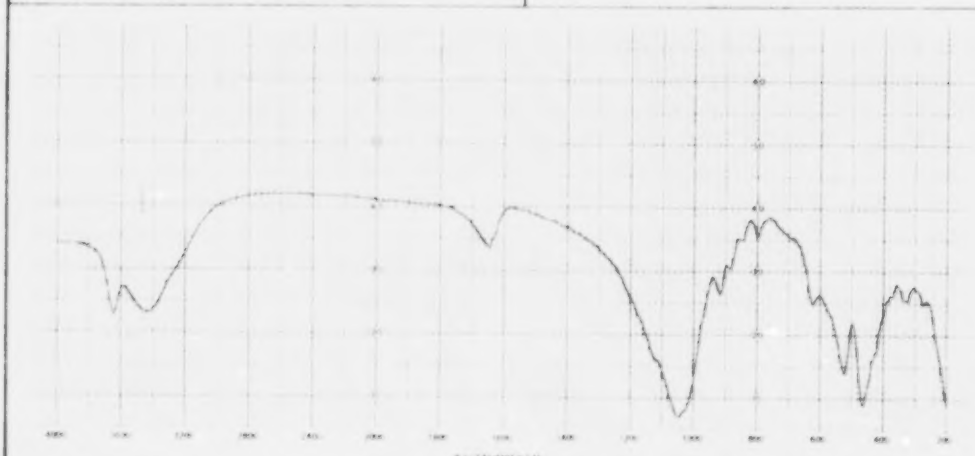
MINERAL NAME Mg-VERMICULITE	SUB-GROUP	GROUP VERMICULITES	CLASS PHYLLOSILICATES	SPECTRA NO 352																				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																						
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:																				
ORIGIN OF SAMPLE Kenya, AFRICA		REMARKS		PARTICLE SIZE < 2 μm CONC 1 mg																				
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr><td>A</td><td>A₂</td><td>3430</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1650</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>1000</td><td>s</td></tr> <tr><td>D</td><td>D₂</td><td>660</td><td>m</td></tr> <tr><td></td><td>D₃</td><td>440</td><td>s</td></tr> </table>	A	A ₂	3430	ms	B	B ₂	1650	mw		D ₁	1000	s	D	D ₂	660	m		D ₃	440	s
A	A ₂	3430	ms																					
B	B ₂	1650	mw																					
	D ₁	1000	s																					
D	D ₂	660	m																					
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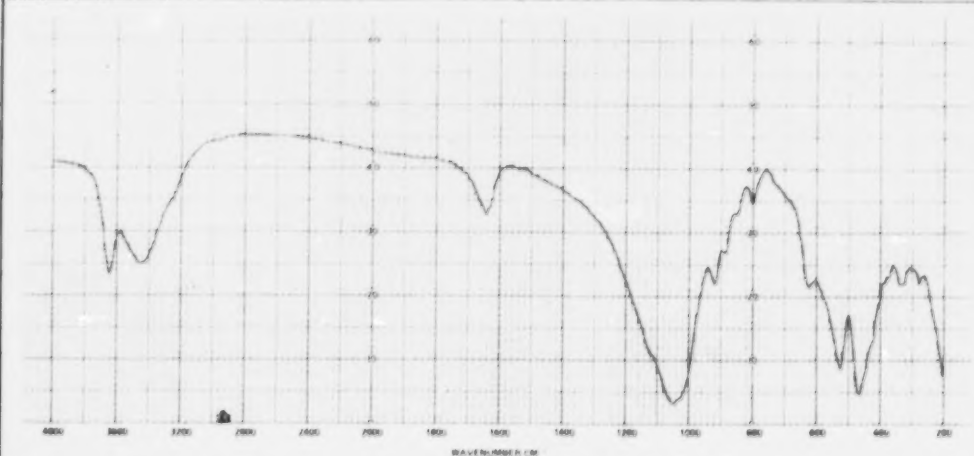
MINERAL NAME K-VERMICULITE	SUB GROUP	GROUP VERMICULITES	CLASS PHYLLOSILICATES	SPECTRA NO. 354																	
CHEMICAL FORMULA (IDEAL) $\sim\text{Mg}_3(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2 \cdot \text{K}(\text{H}_2\text{O})_{4.0}$		CHEMICAL FORMULA (ACTUAL)																			
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:																				
ORIGIN OF SAMPLE Kenya, AFRICA	REMARKS		PARTICLE SIZE < 2 μm	CONC 1 mg																	
			MAJOR ABSORPTION BANDS (cm⁻¹)																		
			<table> <tr> <td>A</td> <td>A₂</td> <td>3450</td> <td>inw</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1635</td> <td>w</td> </tr> <tr> <td></td> <td>D₁</td> <td>1000</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>660</td> <td>mw</td> </tr> <tr> <td></td> <td>D₃</td> <td>420</td> <td>ms</td> </tr> </table>		A	A ₂	3450	inw	B	B ₂	1635	w		D ₁	1000	s	D	D ₂	660	mw	
A	A ₂	3450	inw																		
B	B ₂	1635	w																		
	D ₁	1000	s																		
D	D ₂	660	mw																		
	D ₃	420	ms																		

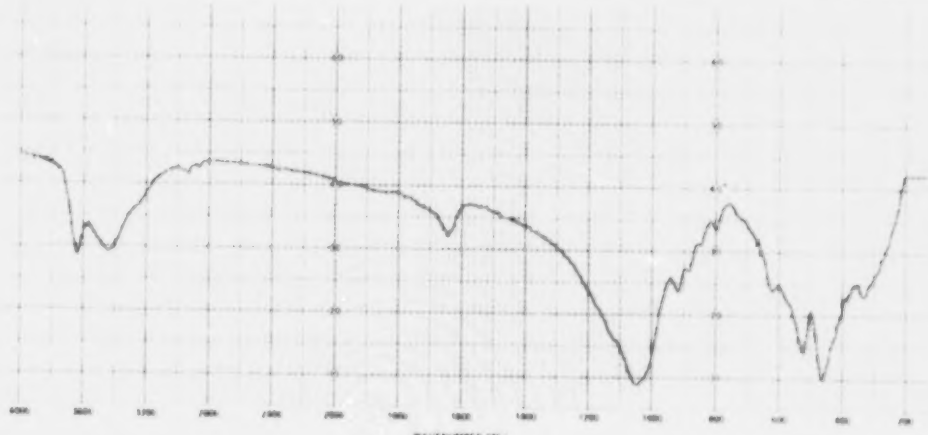
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:			
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

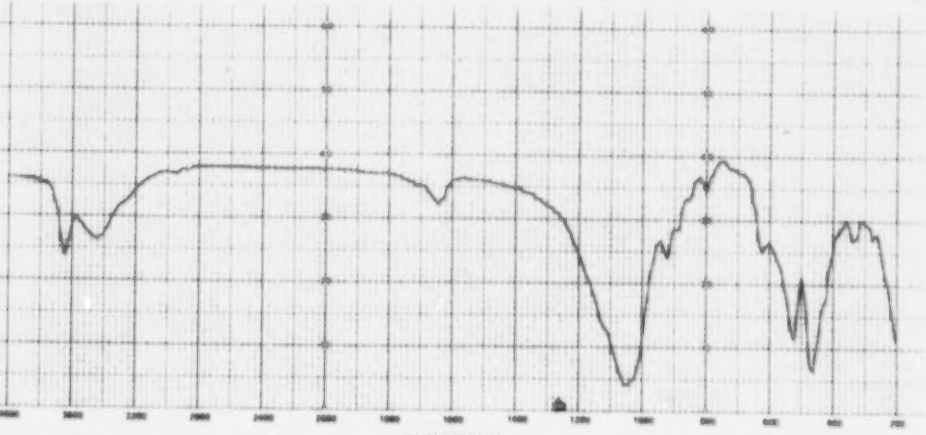
MINERAL NAME Mg-BEIDELLITE	SUB GROUP DIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 399																					
CHEMICAL FORMULA (IDEAL) $(M^{+})_{0.5}(Al_2)(Si_{3.5}Al_{0.5})O_{10}(OH)_2$		CHEMICAL FORMULA (ACTUAL)																							
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m 12)	a: α :	b: SEE β : MONTMORILLONITE	c: γ : Z: D:																					
ORIGIN OF SAMPLE Synthetic	REMARKS		PARTICLE SIZE	CONC 1 mg																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																						
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3663</td> <td>mw</td> </tr> <tr> <td></td> <td>A₂</td> <td>3440</td> <td>m</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1639</td> <td>mw</td> </tr> <tr> <td>D</td> <td>D₁</td> <td>1047</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>530</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>468</td> <td>ms</td> </tr> </table>		A	A ₁	3663	mw		A ₂	3440	m	B	B ₂	1639	mw	D	D ₁	1047	ms			530	ms	
A	A ₁	3663	mw																						
	A ₂	3440	m																						
B	B ₂	1639	mw																						
D	D ₁	1047	ms																						
		530	ms																						
	D ₃	468	ms																						

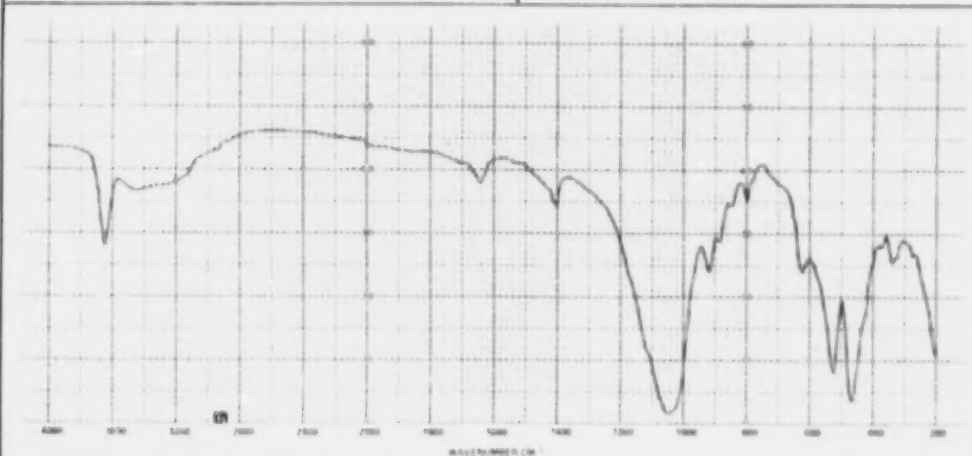
MINERAL NAME Ca-BEIDELLITE	SUB GROUP DIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 397																													
CHEMICAL FORMULA (IDEAL) $(M^{+})_{0.5}(Al_2)(Si_{3.5}Al_{0.5})O_{10}(OH)_2$		CHEMICAL FORMULA (ACTUAL)																															
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:																													
ORIGIN OF SAMPLE Putnam, MISSOURI, USA	REMARKS		PARTICLE SIZE <0.2 μm	CONC 1 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3630</td> <td>ms</td> </tr> <tr> <td></td> <td>A₂</td> <td>3450</td> <td>ms</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1639</td> <td>m</td> </tr> <tr> <td></td> <td>D₁</td> <td>1032</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>910</td> <td>ms</td> </tr> <tr> <td>D</td> <td></td> <td>525</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>467</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>421</td> <td>s</td> </tr> </table>		A	A ₁	3630	ms		A ₂	3450	ms	B	B ₂	1639	m		D ₁	1032	s			910	ms	D		525	s		D ₃	467	s	
A	A ₁	3630	ms																														
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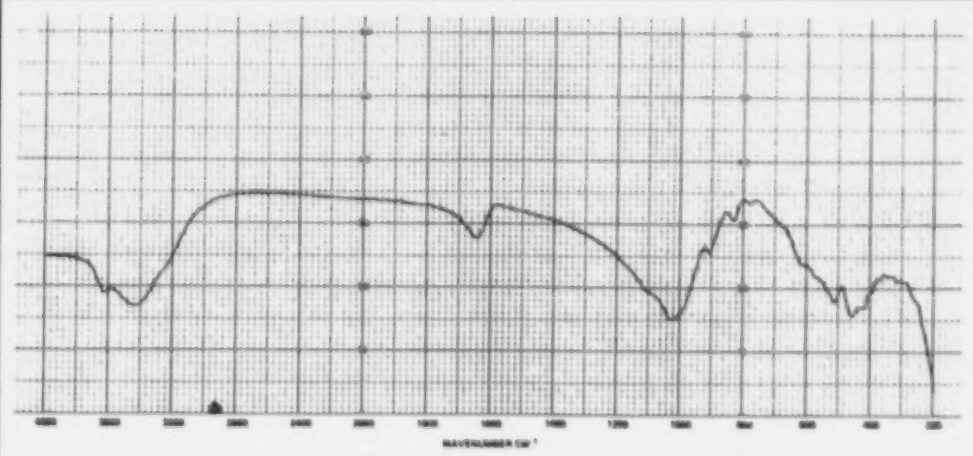
MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO.		
Mg-MONTMORILLONITE	DIOCTAHEDRAL	SMECTITE	PHYLLOSILICATES	389		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
$(M^{+})_{0.33}(Al,Mg,Fe)_2(Si)_4O_{10}(OH)_2 \cdot nH_2O$		$(Mg_{0.12})(Al_{1.54}Mg_{0.33}Fe_{0.16})(Si_{3.91}Al_{0.09})O_{10}(OH)_2$				
CRYSTAL SYSTEM	SPACE GROUP	a: 5.17 α:	b: 8.94 β: 99°54'	c: 9.95 γ:		
MONOCLINIC	C2/m (12)		Z: 1	D: 2-3		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.		
Clay Spur, Wyoming, USA			< 2 μm	1 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₁	3640	m
				A ₂	3430	m
			B	B ₂	1640	mw
				D ₁	1043	s
					914	m
					882	mw
			D	D ₂	843	mw
					620	m
					520	ms
	D ₃	461	s			
		332	m			
		321	m			

MINERAL NAME	SUB-GROUP	GROUP	CLASS	SPECTRA NO.																																													
Ca-MONTMORILLONITE	DIOCTAHEDRAL	SMECTITES	PHYLLOSILICATES	388																																													
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																															
		$(Ca_{0.12})(Al_{1.54}Mg_{0.33}Fe_{0.16})(Si_{3.91}Al_{0.09})O_{10}(OH)_2$																																															
CRYSTAL SYSTEM	SPACE GROUP																																																
	()	a:	b:	c:																																													
		$\alpha:$	$\beta:$	$\gamma:$																																													
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.																																													
Clay Spur, Wyoming, USA			< 2 μm	1 mg																																													
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																														
			<table><tr><td>A</td><td>A₁</td><td>3643</td><td>m</td></tr><tr><td></td><td>A₂</td><td>3440</td><td>m</td></tr><tr><td>B</td><td>B₂</td><td>1640</td><td>mw</td></tr><tr><td></td><td>D₁</td><td>1043</td><td>s</td></tr><tr><td></td><td></td><td>916</td><td>ms</td></tr><tr><td></td><td></td><td>883</td><td>m</td></tr><tr><td></td><td>D₂</td><td>847</td><td>mw</td></tr><tr><td>D</td><td></td><td>618</td><td>ms</td></tr><tr><td></td><td></td><td>520</td><td>s</td></tr><tr><td></td><td>D₃</td><td>461</td><td>s</td></tr><tr><td></td><td></td><td>332</td><td>m</td></tr><tr><td></td><td></td><td>321</td><td>ms</td></tr></table>		A	A ₁	3643	m		A ₂	3440	m	B	B ₂	1640	mw		D ₁	1043	s			916	ms			883	m		D ₂	847	mw	D		618	ms			520	s		D ₃	461	s			332	m	
A	A ₁	3643	m																																														
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	D ₂	847	mw																																														
D		618	ms																																														
		520	s																																														
	D ₃	461	s																																														
		332	m																																														
		321	ms																																														

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRUM NO.			
Na -MONTMORILLONITE	DIOCTAHEDRAL	SMECTITE	PHYLLOSILICATES	410			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
		$(\text{Na}_{0.24})(\text{Al}_{1.54}\text{Mg}_{0.33}\text{Fe}_{0.16}^{3+}\text{Si}_{3.91}\text{Al}_{0.09}\text{O}_{10}(\text{OH})_2$					
CRYSTAL SYSTEM	SPACE GROUP						
	()	a:	b:	c:			
		$\alpha:$	$\beta:$	$\gamma:$			
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE			
Clay Spur, Wyoming, USA				<0.2 μm			
				CONC.			
				1 mg			
				MAJOR ABSORPTION BANDS (cm⁻¹)			
				A	A ₁	3642	mw
				A	A ₂	3440	mw
				B	B ₂	1630	mw
					D ₁	1043	s
						913	m
						880	m
				D	D ₂	850	mw
						618	
						520	ms
				D ₃		460	s
						332	m

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRUM NO.		
K ⁺ -MONTMORILLONITE	DIOCTAHEDRAL	SMECTITES	PHYLLOSILICATES	393		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
		(K _{0.24})(Al _{1.54} Mg _{0.33} Fe _{0.16} ³⁺ Si _{3.91} Al _{0.09} O ₁₀ (OH) ₂)				
CRYSTAL SYSTEM	SPACE GROUP					
	()	a:	b:	c:		
		α:	β:	γ:		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC.		
Clay Spur, Wyoming, USA				1 mg		
			MAJOR ABSORPTION BANDS (cm ⁻¹)			
			A	A ₁	3640	m
			A	A ₂	3440	m
			B	B ₂	1640	mw
				D ₁	1042	s
					916	m
					883	mw
			D	D ₂	847	mw
					620	m
					521	s
					462	s
			D ₃		334	m
					321	m

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
NH ₄ -MONTMORILLONITE	DIOCTAHEDRAL	SMECTITES	PHYLLOSILICATES	384			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)					
CRYSTAL SYSTEM	SPACE GROUP						
	()	a:	b:	c:			
		α:	β:	γ:			
				Z:			
				D:			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Clay Spur, Wyoming, USA				0.2-2 μm			
				CONC.			
				1 mg			
				MAJOR ABSORPTION BANDS (cm ⁻¹)			
				A	A ₁	3644	mw
					A ₂ -A ₃	3435	mw
						3300)	
				B	B ₂	1640	w
				C	C	1400	mw
						1042	s
					D ₁	916	m
						884	mw
				D	D ₂	846	mw
						620	m
						520	s
						462	s
					D ₃	338	m
						321	m

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO			
MONTMORILLONITE	DIOCTAHEDRAL	SMECTITES	PHYLLOSILICATES	390			
CHEO-TYPE	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
			(Na _{0.12} Ca _{0.04})(Al _{1.43} Mg _{0.66} Fe _{0.03})(Si _{3.99} Al _{0.01})O ₁₀ (OH) ₂				
CRYSTAL SYSTEM	SPACE GROUP						
	()	a:	b:	c:			
		α:	β:	γ:			
			Z:	D:			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE			
Otay, CALIFORNIA, USA				1 mg			
				MAJOR ABSORPTION BANDS (cm⁻¹)			
				A	A ₁	3630	ms
					A ₂	3440	ms
				B	B ₂	1640	m
						1030	ms
					D ₁	910	m
						835	mw
				D	D ₂	615	m
						513	ms
					D ₃	460	ms

MINERAL NAME Ca-MONTMORILLONITE	SUB GROUP DIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 404																																					
CHEO-TYPE	CHEMICAL FORMULA (IDEAL) $\text{Ca}_{0.16}(\text{Al}, \text{Mg})_2\text{Si}_4\text{O}_{10}(\text{OH})_2 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL) $\text{Ca}_{0.19}(\text{Al}_{1.51}\text{Mg}_{0.40}\text{Fe}_{0.13})[\text{Si}_{3.93}\text{Al}_{0.07}\text{O}_{10}(\text{OH})_2]$																																						
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:																																								
ORIGIN OF SAMPLE Chamber, ARIZONA, USA	REMARKS		PARTICLE SIZE	CONC 1 mg																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																						
			<table border="1"> <tr><td>A</td><td>A₁</td><td>3630</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3450</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>ms</td></tr> <tr><td></td><td></td><td>1030</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>911</td><td>ms</td></tr> <tr><td></td><td></td><td>837</td><td>m</td></tr> <tr><td>D</td><td>D₂</td><td>618</td><td>ms</td></tr> <tr><td></td><td></td><td>516</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>460</td><td>s</td></tr> <tr><td></td><td></td><td>320</td><td>ms</td></tr> </table>		A	A ₁	3630	ms		A ₂	3450	ms	B	B ₂	1640	ms			1030	s		D ₁	911	ms			837	m	D	D ₂	618	ms			516	s		D ₃	460	s	
A	A ₁	3630	ms																																						
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		837	m																																						
D	D ₂	618	ms																																						
		516	s																																						
	D ₃	460	s																																						
		320	ms																																						

MINERAL NAME MONTMORILLONITE	SUB GROUP DIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 408																																					
	CHEMICAL FORMULA (IDEAL) $(\text{Na}, \text{Ca})_{0.33}(\text{Al}, \text{Mg})_2\text{Si}_4\text{O}_{10}(\text{OH})_2 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL) $(\text{H}^+)_{0.30}(\text{Al}_{1.68}\text{Mg}_{0.23}\text{Fe}^{3+}_{0.08}\text{Fe}^{2+}_{0.01})[\text{Si}_{3.94}\text{Al}_{0.06}\text{O}_{10}(\text{OH})_2]$																																						
CRYSTAL SYSTEM	SPACE GROUP () a: b: c: Z: D: α: β: γ:																																								
ORIGIN OF SAMPLE Togo, Tottori, JAPAN	REMARKS		PARTICLE SIZE	CONC 1 mg																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																						
			<table border="1"> <tr><td>A</td><td>A₁</td><td>3642</td><td>m</td></tr> <tr><td></td><td>A₂</td><td>3450</td><td>m</td></tr> <tr><td>B</td><td>B₂</td><td>1639</td><td>mw</td></tr> <tr><td></td><td></td><td>1043</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>914</td><td>ms</td></tr> <tr><td></td><td></td><td>882</td><td>m</td></tr> <tr><td>D</td><td>D₂</td><td>618</td><td>ms</td></tr> <tr><td></td><td></td><td>522</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>461</td><td>s</td></tr> <tr><td></td><td></td><td>330</td><td>ms</td></tr> </table>		A	A ₁	3642	m		A ₂	3450	m	B	B ₂	1639	mw			1043	s		D ₁	914	ms			882	m	D	D ₂	618	ms			522	ms		D ₃	461	s	
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D	D ₂	618	ms																																						
		522	ms																																						
	D ₃	461	s																																						
		330	ms																																						

MINERAL NAME NONTRONITE	SUB GROUP DIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 386																												
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $\text{Ca}_{0.23}(\text{Fe}_{1.93}\text{Mg}_{0.12}\text{Al}_{0.05})(\text{Si}_{3.50}\text{Al}_{0.50})\text{O}_{10}(\text{OH})_2$																														
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP C2/m (12)	a: 5.23 α:	b: 9.11 β:	c: 15~15.5 γ:																												
ORIGIN OF SAMPLE Garfield, WASHINGTON, USA		REMARKS	PARTICLE SIZE < 2 μm	CONC 1 mg																												
			MAJOR ABSORPTION BANDS (cm^{-1}) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3575</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>3430</td> <td>ms</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1637</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1020</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>812</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>487</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>420</td> <td>ms</td> </tr> </table>		A	A ₁	3575	m			3430	ms	B	B ₂	1637	mw		D ₁	1020	ms	D	D ₂	812	mw			487	ms		D ₃	420	ms
A	A ₁	3575	m																													
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D	D ₂	812	mw																													
		487	ms																													
	D ₃	420	ms																													

MINERAL NAME NONTRONITE	SUB GROUP DIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO A274																												
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																														
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:																												
ORIGIN OF SAMPLE Calfan, WASHINGTON, USA		REMARKS	PARTICLE SIZE	CONC 3 mg																												
			MAJOR ABSORPTION BANDS (cm^{-1}) <table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3578</td> <td>m</td> </tr> <tr> <td></td> <td>A₃</td> <td>3340</td> <td>m</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1645</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1017</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>813</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>489</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>420</td> <td>s</td> </tr> </table>		A	A ₂	3578	m		A ₃	3340	m	B	B ₂	1645	mw		D ₁	1017	s	D	D ₂	813	m			489	s		D ₃	420	s
A	A ₂	3578	m																													
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B	B ₂	1645	mw																													
	D ₁	1017	s																													
D	D ₂	813	m																													
		489	s																													
	D ₃	420	s																													

MINERAL NAME SAPONITE	SUB GROUP TRIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO. A272																																																									
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(\text{H}^+)_{0.45}(\text{H}_2)_{2.91}\text{Fe}^{3+}_{0.16}\text{Al}_{0.03}(\text{Si}_{3.58}\text{Al}_{0.42})\text{O}_{10}(\text{OH})_2$																																																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: 5.3 α:	b: 9.14 β:	c: ~15.4 γ: Z: D: 2.10																																																									
ORIGIN OF SAMPLE Krugersdorp, AFRICA	REMARKS		PARTICLE SIZE < 5 μm	CONC. 2 mg																																																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																										
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3695</td><td>mw</td></tr> <tr><td></td><td></td><td>3645</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3520</td><td>sh</td></tr> <tr><td></td><td>A₃</td><td>3360</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1660</td><td>m</td></tr> <tr><td></td><td>D₁</td><td>1050</td><td>sh</td></tr> <tr><td></td><td></td><td>1000</td><td>s</td></tr> <tr><td></td><td></td><td>812</td><td>mw</td></tr> <tr><td></td><td>D₂</td><td>700</td><td>sh</td></tr> <tr><td></td><td></td><td>660</td><td>m</td></tr> <tr><td>D</td><td></td><td>530</td><td>sh</td></tr> <tr><td></td><td></td><td>465</td><td>sh</td></tr> <tr><td></td><td>D₃</td><td>450</td><td>s</td></tr> <tr><td></td><td></td><td>380</td><td></td></tr> <tr><td></td><td></td><td>360</td><td></td></tr> </table>		A	A ₁	3695	mw			3645	ms		A ₂	3520	sh		A ₃	3360	ms	B	B ₂	1660	m		D ₁	1050	sh			1000	s			812	mw		D ₂	700	sh			660	m	D		530	sh			465	sh		D ₃	450	s			380		
A	A ₁	3695	mw																																																										
		3645	ms																																																										
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	A ₃	3360	ms																																																										
B	B ₂	1660	m																																																										
	D ₁	1050	sh																																																										
		1000	s																																																										
		812	mw																																																										
	D ₂	700	sh																																																										
		660	m																																																										
D		530	sh																																																										
		465	sh																																																										
	D ₃	450	s																																																										
		380																																																											
		360																																																											

MINERAL NAME SAPONITE	SUB GROUP TRIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO. 385																													
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(\text{H}^+)_{0.45}(\text{H}_2)_{2.21}\text{Al}_{0.54}\text{Fe}^{3+}_{0.09}(\text{Si}_{3.22}\text{Al}_{0.78})\text{O}_{10}(\text{OH})_2$																															
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c: Z: D:																													
		α:	β:	γ:																													
ORIGIN OF SAMPLE Staffin Skye	REMARKS		PARTICLE SIZE	CONC. 3 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3687</td><td>mw</td></tr> <tr><td></td><td></td><td>3620</td><td>mw</td></tr> <tr><td></td><td>A₂</td><td>3445</td><td>m</td></tr> <tr><td>B</td><td>B₂</td><td>1638</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>1000</td><td>s</td></tr> <tr><td>D</td><td>D₂</td><td>658</td><td>ms</td></tr> <tr><td></td><td></td><td>522</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>438</td><td>s</td></tr> </table>		A	A ₁	3687	mw			3620	mw		A ₂	3445	m	B	B ₂	1638	mw		D ₁	1000	s	D	D ₂	658	ms			522	ms	
A	A ₁	3687	mw																														
		3620	mw																														
	A ₂	3445	m																														
B	B ₂	1638	mw																														
	D ₁	1000	s																														
D	D ₂	658	ms																														
		522	ms																														
	D ₃	438	s																														

MINERAL NAME SAPONITE (Na-)	SUB GROUP TRIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 400																																
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:																																
ORIGIN OF SAMPLE From Dr. H. Pezerat		REMARKS		PARTICLE SIZE 3 mg																																
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3685</td> <td>ms</td> </tr> <tr> <td></td> <td>A₂</td> <td>3620</td> <td>ms</td> </tr> <tr> <td></td> <td>A₂</td> <td>3460</td> <td>s</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1640</td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>1000</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>665</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>656</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>437</td> <td>s</td> </tr> </table>	A	A ₁	3685	ms		A ₂	3620	ms		A ₂	3460	s	B	B ₂	1640	ms		D ₁	1000	s	D	D ₂	665	s			656	s		D ₃	437	s
A	A ₁	3685	ms																																	
	A ₂	3620	ms																																	
	A ₂	3460	s																																	
B	B ₂	1640	ms																																	
	D ₁	1000	s																																	
D	D ₂	665	s																																	
		656	s																																	
	D ₃	437	s																																	

MINERAL NAME Ca²⁺-SAPONITE	SUB GROUP TRIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO 406																																
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:																																
ORIGIN OF SAMPLE From Dr. A. Weiss		REMARKS		PARTICLE SIZE 3 mg																																
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₁</td> <td>3695</td> <td>w</td> </tr> <tr> <td></td> <td>A₂</td> <td>3440</td> <td>ms</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1660</td> <td>m</td> </tr> <tr> <td></td> <td>D₁</td> <td>1100</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>1000</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>660</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>450</td> <td>ms</td> </tr> <tr> <td></td> <td>D₃</td> <td>370</td> <td>sh m</td> </tr> </table>	A	A ₁	3695	w		A ₂	3440	ms	B	B ₂	1660	m		D ₁	1100	sh			1000	ms	D	D ₂	660	m			450	ms		D ₃	370	sh m
A	A ₁	3695	w																																	
	A ₂	3440	ms																																	
B	B ₂	1660	m																																	
	D ₁	1100	sh																																	
		1000	ms																																	
D	D ₂	660	m																																	
		450	ms																																	
	D ₃	370	sh m																																	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO	
STEVENSITE	TRIOCTAHEDRAL	SMECTITES	PHYLLOSILICATES	A267	
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)			
		(Mg _{5.31} Mn _{0.20} Fe _{0.04})Si _{8.01} O ₂₀ .(OH) ₄ (Ca _{0.36} Na _{0.10})			
CRYSTAL SYSTEM	SPACE GROUP	a: b/√3 α:	b: 9.12 β:	c: VARIABLE γ:	
MONOCLINIC	()			Z: 1 D: 2.565	
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC	
Obori Mine, Yamagata, JAPAN			< 45 μm	3 mg	
			MAJOR ABSORPTION BANDS (cm ⁻¹)		
		A	A ₁	3700	mw
			A ₂	3465	ms
		B	B ₂	1634	mw
			D ₁	1028	ms
		D	D ₂	657	mw
			D ₃	450	s

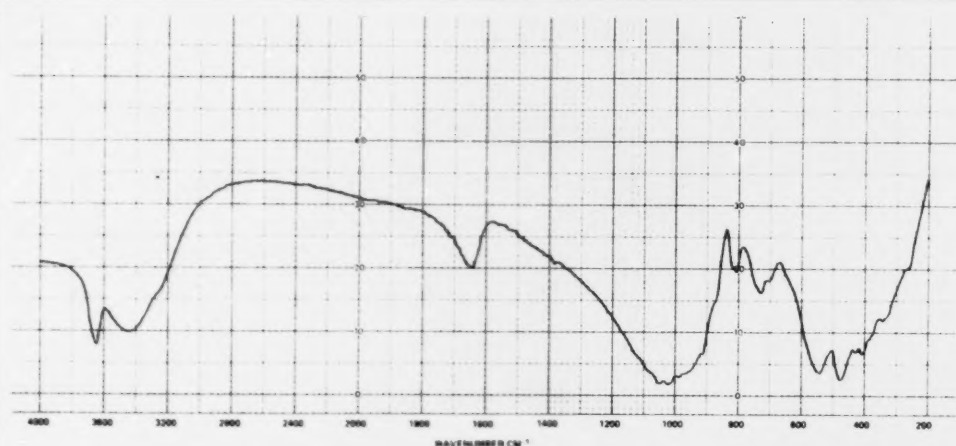
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																
HECTORITE	TRIOCTAHEDRAL	SMECTITES	PHYLLOSILICATES	A306																
CHEMICAL FORMULA (IDEAL)			CHEMICAL FORMULA (ACTUAL)																	
$(\text{M}_y\text{nH}_2\text{O})(\text{Mg}_{3-y}\text{Li}_y)\text{Si}_4\text{O}_{10}(\text{OH})_2$																				
CRYSTAL SYSTEM	SPACE GROUP	a: 5.25 α :	b: 9.18 β : $\sim 99^\circ$	c: >10 γ :																
MONOCLINIC	PROBABLY () C2/m			Z: D: 2~3																
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE CONC																
Hector, CALIFORNIA, USA				< 2 μm 3 mg																
				MAJOR ABSORPTION BANDS (cm ⁻¹)																
				<table><tr><td>A</td><td>A₁</td><td>3640</td><td>m</td></tr><tr><td></td><td>A₂</td><td>3445</td><td>ms</td></tr><tr><td>B</td><td>B₂</td><td>1638</td><td>m</td></tr><tr><td></td><td>D₁</td><td>1005</td><td>ms</td></tr><tr><td>D</td><td>D₃</td><td>465</td><td>s</td></tr></table>	A	A ₁	3640	m		A ₂	3445	ms	B	B ₂	1638	m		D ₁	1005	ms
A	A ₁	3640	m																	
	A ₂	3445	ms																	
B	B ₂	1638	m																	
	D ₁	1005	ms																	
D	D ₃	465	s																	

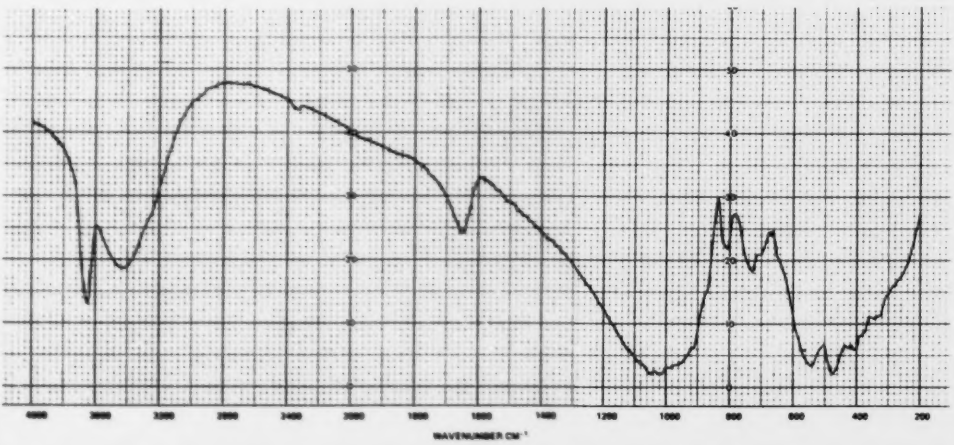
MINERAL NAME SAUCONITE	SUB GROUP TRIOCTAHEDRAL	GROUP SMECTITES	CLASS PHYLLOSILICATES	SPECTRA NO A268																									
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(H^+)_{0.33}(Zn_{1.48}Al_{0.74}Fe^{3+}_{0.40}Mg_{0.14})(Si_{3.01}Al_{0.99})O_{10}(OH)_2$																											
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:																									
ORIGIN OF SAMPLE Friedensville, PENNSYLVANIA, USA	REMARKS		PARTICLE SIZE	CONC 2 mg																									
			MAJOR ABSORPTION BANDS (cm ⁻¹)																										
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3647</td> <td>m</td> </tr> <tr> <td></td> <td>A₃</td> <td>3345</td> <td>mw</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1647</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>993</td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>647</td> <td>m</td> </tr> <tr> <td></td> <td></td> <td>441</td> <td>s</td> </tr> <tr> <td></td> <td>D₃</td> <td>420</td> <td>s</td> </tr> </table>		A	A ₁	3647	m		A ₃	3345	mw	B	B ₂	1647	mw		D ₁	993	s	D	D ₂	647	m			441	s	
A	A ₁	3647	m																										
	A ₃	3345	mw																										
B	B ₂	1647	mw																										
	D ₁	993	s																										
D	D ₂	647	m																										
		441	s																										
	D ₃	420	s																										

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																	
KAOLINITE/SMECTITE	DIOCTAHEDRAL	KAOLIN-SMECTITE	PHYLLOSILICATES	336																																																	
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																			
		$[Al_4Si_4O_{10}(OH)_8] + [K_{0.2}Na_{0.2}Ca_{0.2}Mg_{0.2}(Al_{2.5}Fe_{1.0}Mg_{0.5})_{0.7}Al_{0.7}O_{20}(OH)_4]$																																																			
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																																	
	()	α:	β:	γ:																																																	
ORIGIN OF SAMPLE		REMARKS		CONC																																																	
Tepakan, Campeche, MEXICO				1 mg																																																	
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr><td>A</td><td>A₁</td><td>3705</td><td>m</td></tr> <tr><td rowspan="2"></td><td rowspan="2"></td><td>3658</td><td>sh</td></tr> <tr><td>3630</td><td>ms</td></tr> <tr><td rowspan="2"></td><td rowspan="2"></td><td>3440</td><td>m</td></tr> <tr><td>A₂</td><td></td><td></td></tr> <tr><td>B</td><td>B₂</td><td>1638</td><td>mw</td></tr> <tr><td rowspan="4"></td><td rowspan="4"></td><td>1102</td><td>s</td></tr> <tr><td>1030</td><td>s</td></tr> <tr><td>1005</td><td>s</td></tr> <tr><td>910</td><td>ms</td></tr> <tr><td rowspan="4"></td><td rowspan="4"></td><td>789</td><td>mw</td></tr> <tr><td>747</td><td>mw</td></tr> <tr><td>692</td><td>m</td></tr> <tr><td>528</td><td>s</td></tr> <tr><td rowspan="3"></td><td rowspan="3"></td><td>465</td><td>s</td></tr> <tr><td>421</td><td>s</td></tr> <tr><td>339</td><td>ms</td></tr> </table>	A	A ₁	3705	m			3658	sh	3630	ms			3440	m	A ₂			B	B ₂	1638	mw			1102	s	1030	s	1005	s	910	ms			789	mw	747	mw	692	m	528	s			465	s	421	s	339	ms
A	A ₁	3705	m																																																		
		3658	sh																																																		
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B	B ₂	1638	mw																																																		
		1102	s																																																		
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		692	m																																																		
		528	s																																																		
		465	s																																																		
		421	s																																																		
		339	ms																																																		

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																			
MICA/SMECTITE	DIOCTAHEDRAL	MICA-SMECTITE	PHYLLOSILICATES	340																																			
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																					
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																			
	()	α:	β:	γ:																																			
ORIGIN OF SAMPLE		REMARKS		CONC																																			
Iwami Mine, JAPAN				3 mg																																			
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr><td>A</td><td>A₁</td><td>3635</td><td>m</td></tr> <tr><td rowspan="2"></td><td rowspan="2"></td><td>3440</td><td>mw</td></tr> <tr><td>A₂</td><td></td><td></td></tr> <tr><td>B</td><td>B₂</td><td>1637</td><td>mw</td></tr> <tr><td rowspan="3"></td><td rowspan="3"></td><td>1019</td><td>s</td></tr> <tr><td>909</td><td>ms</td></tr> <tr><td>820</td><td>m</td></tr> <tr><td rowspan="3"></td><td rowspan="3"></td><td>749</td><td>mw</td></tr> <tr><td>523</td><td>s</td></tr> <tr><td>466</td><td>s</td></tr> <tr><td></td><td></td><td>413</td><td>ms</td></tr> </table>	A	A ₁	3635	m			3440	mw	A ₂			B	B ₂	1637	mw			1019	s	909	ms	820	m			749	mw	523	s	466	s			413	ms
A	A ₁	3635	m																																				
		3440	mw																																				
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B	B ₂	1637	mw																																				
		1019	s																																				
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		820	m																																				
		749	mw																																				
		523	s																																				
		466	s																																				
		413	ms																																				

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																								
Na-RECTORITE	DIOCTAHEDRAL	MICA-SMECTITE	PHYLLOSILICATES	345																																								
MICA = 50%	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																									
			$(\text{Na}_{1.65}\text{K}_{0.07}\text{Ca}_{0.04})(\text{Al}_{4.00}\text{Fe}_{0.02}\text{Mg}_{0.07})(\text{Si}_6\text{Al}_2)\text{O}_{10}(\text{OH})_4$ +(0.75BEIDELLITE)+(0.25 MONT)																																									
CRYSTAL SYSTEM	SPACE GROUP	a: 5.12 α:	b: 8.90 β: ≈99°	c: 24.99 γ: Z: D:																																								
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																								
Fort Sandeman, Baluchistan, PAKISTAN				CONC 1.5 mg																																								
				MAJOR ABSORPTION BANDS (cm⁻¹)																																								
				<table><tr><td>A</td><td>A₁</td><td>3645</td><td>s</td></tr><tr><td></td><td>A₂</td><td>3440</td><td>s</td></tr><tr><td>B</td><td>B₂</td><td>1640</td><td>ms</td></tr><tr><td></td><td></td><td>1047</td><td>s</td></tr><tr><td></td><td>D₁</td><td>1020</td><td>s</td></tr><tr><td></td><td></td><td>815</td><td>ms</td></tr><tr><td></td><td>D₂</td><td>727</td><td>ms</td></tr><tr><td></td><td></td><td>700</td><td>ms</td></tr><tr><td></td><td></td><td>539</td><td>s</td></tr><tr><td></td><td>D₃</td><td>473</td><td>s</td></tr><tr><td></td><td></td><td>405</td><td></td></tr></table>	A	A ₁	3645	s		A ₂	3440	s	B	B ₂	1640	ms			1047	s		D ₁	1020	s			815	ms		D ₂	727	ms			700	ms			539	s		D ₃	473	s
A	A ₁	3645	s																																									
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B	B ₂	1640	ms																																									
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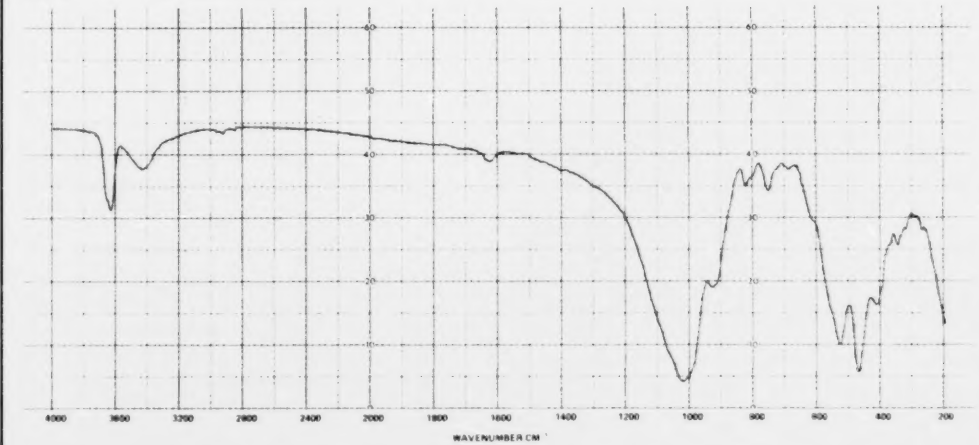
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																												
Na-RECTORITE	DIOCTAHEDRAL	MICA-SMECTITE	PHYLLOSILICATES	A154																																												
MICA = 50%	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																													
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																												
	()	α:	β:	γ:																																												
				Z: D:																																												
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																												
Morning Star Mine, VICTORIA				CONC																																												
				2 mg																																												
				MAJOR ABSORPTION BANDS (cm⁻¹)																																												
				<table><tr><td>A</td><td>A₁</td><td>3652</td><td>s</td></tr><tr><td></td><td>A₂</td><td>3430</td><td>ms</td></tr><tr><td>B</td><td>B₂</td><td>1649</td><td>ms</td></tr><tr><td></td><td></td><td>1046</td><td>s</td></tr><tr><td></td><td>D₁</td><td>1017</td><td>s</td></tr><tr><td></td><td></td><td>814</td><td>ms</td></tr><tr><td></td><td></td><td>803</td><td>ms</td></tr><tr><td>D</td><td>D₂</td><td>726</td><td>ms</td></tr><tr><td></td><td></td><td>700</td><td>ms</td></tr><tr><td></td><td></td><td>540</td><td>s</td></tr><tr><td></td><td>D₃</td><td>472</td><td>s</td></tr><tr><td></td><td></td><td>404</td><td>s</td></tr></table>	A	A ₁	3652	s		A ₂	3430	ms	B	B ₂	1649	ms			1046	s		D ₁	1017	s			814	ms			803	ms	D	D ₂	726	ms			700	ms			540	s		D ₃	472	s
A	A ₁	3652	s																																													
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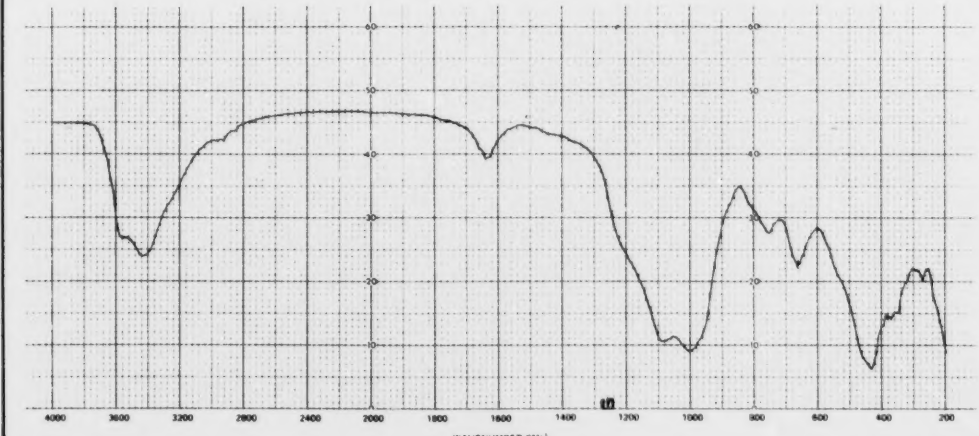
MINERAL NAME MICA/SMECTITE	SUB-GROUP DIOCTAHEDRAL	GROUP MICA-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 341																									
MICA $\approx$ 50%	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(K_{1.19}Na_{0.52}Ca_{0.16})(Al_{7.80}Ti_{0.12}Fe^{3+}_{0.04})(Si_{13.28}Al_{2.72})O_{44}$																										
CRYSTAL SYSTEM	SPACE GROUP	a: α :	b: β :	c: γ : Z: D:																									
ORIGIN OF SAMPLE Groenvlei, Burghersdorf, S. AFRICA	REMARKS		PARTICLE SIZE	CONC 3 mg																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																										
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3643</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3450</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1645</td><td>m</td></tr> <tr><td></td><td>D₁</td><td>1019)</td><td>s</td></tr> <tr><td></td><td></td><td>940)</td><td>s</td></tr> <tr><td></td><td></td><td>535</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>470</td><td>s</td></tr> </table>		A	A ₁	3643	ms		A ₂	3450	ms	B	B ₂	1645	m		D ₁	1019)	s			940)	s			535	s	
A	A ₁	3643	ms																										
	A ₂	3450	ms																										
B	B ₂	1645	m																										
	D ₁	1019)	s																										
		940)	s																										
		535	s																										
	D ₃	470	s																										

MINERAL NAME Na-K-RECTORITE	SUB-GROUP DIOCTAHEDRAL	GROUP MICA-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 333																																													
MICA = 50%	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $(Ca,Mg)_{0.44}(K_{0.60}Na_{0.90}Ca_{0.20})(Al_{7.97}Mg_{0.16}Fe^{0.01})(Si_{12.94}Al_{3.06})O_{44}$																																														
CRYSTAL SYSTEM	SPACE GROUP	a: α :	b: β :	c: γ : Z: D:																																													
ORIGIN OF SAMPLE Goto Mine, Nagasaki, JAPAN	REMARKS		PARTICLE SIZE	CONC 1 mg																																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																																														
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3657</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3450</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1643</td><td>m</td></tr> <tr><td></td><td></td><td>1042)</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>1019)</td><td>s</td></tr> <tr><td></td><td></td><td>933)</td><td>ms</td></tr> <tr><td></td><td></td><td>910)</td><td>ms</td></tr> <tr><td></td><td></td><td>817</td><td>m</td></tr> <tr><td>D</td><td>D₂</td><td>695</td><td>mw</td></tr> <tr><td></td><td></td><td>540</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>469</td><td>s</td></tr> <tr><td></td><td></td><td>404</td><td>s</td></tr> </table>		A	A ₁	3657	ms		A ₂	3450	ms	B	B ₂	1643	m			1042)	s		D ₁	1019)	s			933)	ms			910)	ms			817	m	D	D ₂	695	mw			540	s		D ₃	469	s	
A	A ₁	3657	ms																																														
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B	B ₂	1643	m																																														
		1042)	s																																														
	D ₁	1019)	s																																														
		933)	ms																																														
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		817	m																																														
D	D ₂	695	mw																																														
		540	s																																														
	D ₃	469	s																																														
		404	s																																														

MINERAL NAME K-RECTORITE	SUB GROUP DIOCTAHEDRAL	GROUP MICA-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 332																																									
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																											
		(EXCH) $0.34(K_{1.84}Na_{0.17}Ca_{0.01})(Al_{7.58}Ti_{0.19}Mg_{0.16}Fe^{3+}_{0.03})$ ($Si_{13.37}Al_{2.63}$) $^{0.44}$																																											
CRYSTAL SYSTEM	SPACE GROUP																																												
	$a:$ $b:$ $c:$ $Z:$ $D:$ $\alpha:$ $\beta:$ $\gamma:$																																												
ORIGIN OF SAMPLE Yonago Mine, Nagano, JAPAN	REMARKS		PARTICLE SIZE	CONC 1 mg																																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																																										
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3640</td><td>mw</td></tr> <tr><td></td><td>A₂</td><td>3440</td><td>mw</td></tr> <tr><td>B</td><td>B₂</td><td>1650</td><td>mw</td></tr> <tr><td></td><td></td><td>1020</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>930</td><td>sh ms</td></tr> <tr><td></td><td></td><td>820</td><td>mw</td></tr> <tr><td></td><td>D₂</td><td>805</td><td>mw</td></tr> <tr><td></td><td></td><td>752</td><td>mw</td></tr> <tr><td></td><td></td><td>532</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>472</td><td>s</td></tr> <tr><td></td><td></td><td>408</td><td>ms</td></tr> </table>		A	A ₁	3640	mw		A ₂	3440	mw	B	B ₂	1650	mw			1020	s		D ₁	930	sh ms			820	mw		D ₂	805	mw			752	mw			532	ms		D ₃	472	s	
A	A ₁	3640	mw																																										
	A ₂	3440	mw																																										
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		1020	s																																										
	D ₁	930	sh ms																																										
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	D ₂	805	mw																																										
		752	mw																																										
		532	ms																																										
	D ₃	472	s																																										
		408	ms																																										

MINERAL NAME MICA/SMECTITE	SUB GROUP DIOCTAHEDRAL	GROUP MICA-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 331																									
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																											
MICA = 72% PM = 0.61																													
CRYSTAL SYSTEM	SPACE GROUP																												
	$a:$ $b:$ $c:$ $Z:$ $D:$ $\alpha:$ $\beta:$ $\gamma:$																												
ORIGIN OF SAMPLE Noborikawa, Hokkaido, JAPAN	REMARKS		PARTICLE SIZE	CONC 1 mg																									
			MAJOR ABSORPTION BANDS (cm⁻¹)																										
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3630</td><td>mw</td></tr> <tr><td></td><td>A₂</td><td>3440</td><td>mw</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>mw</td></tr> <tr><td></td><td></td><td>1029</td><td>s</td></tr> <tr><td></td><td>D₁</td><td>913</td><td>sh m</td></tr> <tr><td></td><td></td><td>530</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>468</td><td>ms</td></tr> </table>		A	A ₁	3630	mw		A ₂	3440	mw	B	B ₂	1640	mw			1029	s		D ₁	913	sh m			530	ms	
A	A ₁	3630	mw																										
	A ₂	3440	mw																										
B	B ₂	1640	mw																										
		1029	s																										
	D ₁	913	sh m																										
		530	ms																										
	D ₃	468	ms																										

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																												
MICA/SMECTITE	DIOCTAHEDRAL	MICA-SMECTITE	PHYLLOSILICATES	335																																												
MICA ≈ 90%	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																													
			$(\text{Ca}, \text{Mg})_{0.40}(\text{K})_{2.73}(\text{Al})_{7.37}\text{Ti}_{0.04}\text{Fe}^{3+}_{0.12}\text{Mg}_{0.47}$																																													
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																												
	()	α:	β:	γ:																																												
				Z:																																												
				D:																																												
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																												
Abeshiro Mine, Akita, JAPAN				1 mg																																												
				MAJOR ABSORPTION BANDS (cm⁻¹)																																												
				<table><tr><td>A</td><td>A₁</td><td>3639</td><td>mw</td></tr><tr><td>A</td><td>A₂</td><td>3435</td><td>mw</td></tr><tr><td>B</td><td>B₂</td><td>1625</td><td>w</td></tr><tr><td></td><td>D₁</td><td>1020</td><td>s</td></tr><tr><td></td><td></td><td>926</td><td>ms</td></tr><tr><td></td><td></td><td>822</td><td>mw</td></tr><tr><td></td><td>D₂</td><td>806</td><td>mw</td></tr><tr><td></td><td></td><td>750</td><td>mw</td></tr><tr><td></td><td></td><td>528</td><td>s</td></tr><tr><td></td><td></td><td>469</td><td>s</td></tr><tr><td></td><td>D₃</td><td>409</td><td>ms</td></tr><tr><td></td><td></td><td>346</td><td>m</td></tr></table>	A	A₁	3639	mw	A	A₂	3435	mw	B	B₂	1625	w		D₁	1020	s			926	ms			822	mw		D₂	806	mw			750	mw			528	s			469	s		D₃	409	ms
A	A₁	3639	mw																																													
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		528	s																																													
		469	s																																													
	D₃	409	ms																																													
		346	m																																													

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
CHLORITE-VERMICULITE	TRIOCTAHEDRAL	INTERSTRATIFIED CHLORITE-VERMICULITE	PHYLLOSILICATES	A307		
CORRENSITE (HIGH LAYER CHARGE)	CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)			
CRYSTAL SYSTEM	SPACE GROUP					
	()	a: α:	b: β:	c: γ:		
				Z:		
				D:		
ORIGIN OF SAMPLE	From Dr. Fanning Highfield Soil, Adams County, PENNSYLVANIA, USA		REMARKS	PARTICLE SIZE		
				5-20 μm		
				1 mg		
			MAJOR ABSORPTION BANDS (cm⁻¹)			
			A	A₂	3560	m
			B	B₂	1632	w
				D₁	1085)	s
					1004)	s
D	D₂	753	m			
		665	m			
		433	s			
	D₃	370	sh ms			

MINERAL NAME TOSUDITE	SUB GROUP DI-TRIOCTAHEDRAL	GROUP CHLORITE-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 343																																												
CHLORITE = 50%		CHEMICAL FORMULA (IDEAL)																																														
CRYSTAL SYSTEM		SPACE GROUP																																														
()		a: b: c: Z: D:																																														
ORIGIN OF SAMPLE Hanaoka Mine, Akita, JAPAN		REMARKS		PARTICLE SIZE 2 mg																																												
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr><td>A</td><td>A₁</td><td>3627</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3530</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3400</td><td>ms</td></tr> <tr><td>B</td><td>B₂</td><td>1637</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>1002</td><td>s</td></tr> <tr><td></td><td></td><td>827</td><td>m</td></tr> <tr><td></td><td>D₂</td><td>700</td><td>m</td></tr> <tr><td>D</td><td></td><td>525</td><td>s</td></tr> <tr><td></td><td></td><td>466</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>449</td><td>s</td></tr> <tr><td></td><td></td><td>399</td><td>s</td></tr> </table>	A	A ₁	3627	ms		A ₂	3530	ms		A ₂	3400	ms	B	B ₂	1637	mw		D ₁	1002	s			827	m		D ₂	700	m	D		525	s			466	s		D ₃	449	s			399	s
A	A ₁	3627	ms																																													
	A ₂	3530	ms																																													
	A ₂	3400	ms																																													
B	B ₂	1637	mw																																													
	D ₁	1002	s																																													
		827	m																																													
	D ₂	700	m																																													
D		525	s																																													
		466	s																																													
	D ₃	449	s																																													
		399	s																																													

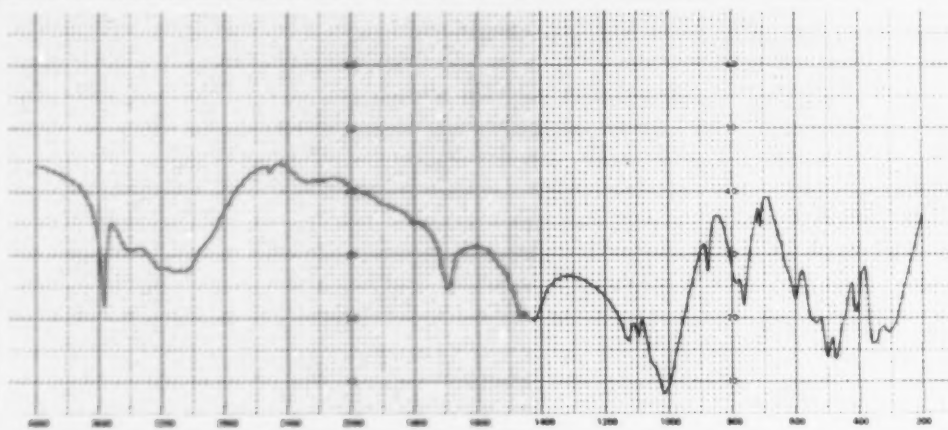
MINERAL NAME TOSUDITE	SUB GROUP DI-TRIOCTAHEDRAL	GROUP CHLORITE-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 338																																																
CHLORITE = 50%		CHEMICAL FORMULA (IDEAL)																																																		
CRYSTAL SYSTEM		SPACE GROUP																																																		
()		a: b: c: Z: D:																																																		
ORIGIN OF SAMPLE Kamikita, Aomori, JAPAN		REMARKS		PARTICLE SIZE 3 mg																																																
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr><td>A</td><td>A₁</td><td>3625</td><td>s</td></tr> <tr><td></td><td>A₂</td><td>3530</td><td>s</td></tr> <tr><td></td><td>A₂</td><td>3400</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1650</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>1020</td><td>s</td></tr> <tr><td></td><td></td><td>940</td><td>sh s</td></tr> <tr><td></td><td>D₂</td><td>823</td><td>ms</td></tr> <tr><td></td><td></td><td>702</td><td>s</td></tr> <tr><td>D</td><td></td><td>525</td><td>s</td></tr> <tr><td></td><td></td><td>465</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>439</td><td>s</td></tr> <tr><td></td><td></td><td>397</td><td>s</td></tr> </table>	A	A ₁	3625	s		A ₂	3530	s		A ₂	3400	s	B	B ₂	1650	ms		D ₁	1020	s			940	sh s		D ₂	823	ms			702	s	D		525	s			465	s		D ₃	439	s			397	s
A	A ₁	3625	s																																																	
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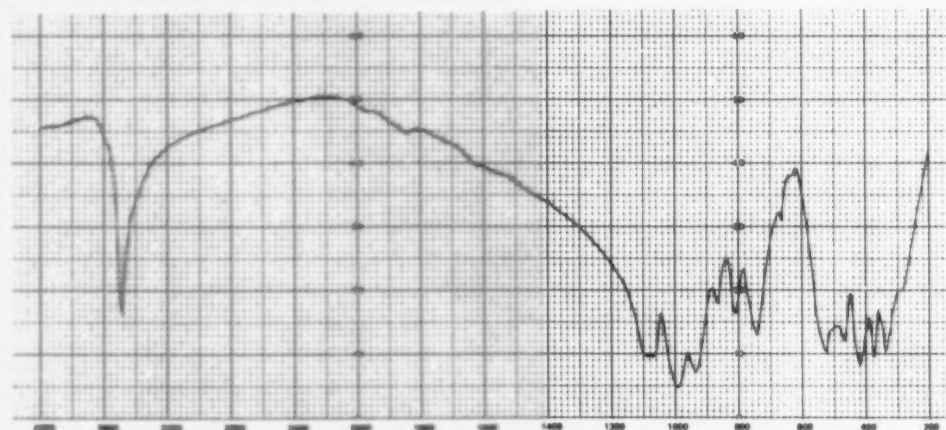
MINERAL NAME CORRENSITE	SUB GROUP TRIOCTAHEDRAL	GROUP CHLORITE-SMECTITE	CLASS PHYLLOSILICATES	SPECTRA NO 339																																
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																
	()	α :	β :	γ :																																
ORIGIN OF SAMPLE Hanaoka Mine, Akita, JAPAN		REMARKS		PARTICLE SIZE 4 mg																																
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table> <tr><td>A</td><td>A₂</td><td>3560</td><td>mw</td></tr> <tr><td></td><td></td><td>3440</td><td>mw</td></tr> <tr><td>B</td><td>B₂</td><td>1634</td><td>mw</td></tr> <tr><td></td><td></td><td>1000</td><td>ms</td></tr> <tr><td></td><td>D₁</td><td>962</td><td>sh m</td></tr> <tr><td>D</td><td>D₂</td><td>665</td><td>m</td></tr> <tr><td></td><td></td><td>441</td><td>ms</td></tr> <tr><td></td><td>D₃</td><td>381</td><td>ms</td></tr> </table>	A	A ₂	3560	mw			3440	mw	B	B ₂	1634	mw			1000	ms		D ₁	962	sh m	D	D ₂	665	m			441	ms		D ₃	381	ms
A	A ₂	3560	mw																																	
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D	D ₂	665	m																																	
		441	ms																																	
	D ₃	381	ms																																	

MINERAL NAME PALYGORSKITE	SUB GROUP	GROUP SEPIOLITE-PALYGORSKITE	CLASS PHYLLOSILICATES*	SPECTRA NO 420																																																				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																						
$(\text{Mg,Al})_2[\text{Si}_4\text{O}_{10}](\text{OH}) \cdot 4\text{H}_2\text{O}$																																																								
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																																																				
MONOCLINIC OR (ORTHORHOMBIC)	Pn ()	α : ≈ 5.21	β : ≈ 17.9	γ : ≈ 12.7																																																				
ORIGIN OF SAMPLE Attapulugus, GEORGIA, USA		REMARKS		PARTICLE SIZE 1 mg																																																				
				MAJOR ABSORPTION BANDS (cm ⁻¹) <table> <tr><td>A</td><td>A₁</td><td>3622</td><td>ms</td></tr> <tr><td></td><td></td><td>3557</td><td>ms</td></tr> <tr><td></td><td>A₂</td><td>3440</td><td>sh</td></tr> <tr><td></td><td>A₃</td><td>3300</td><td>sh</td></tr> <tr><td>B</td><td>B₂</td><td>1660</td><td>m</td></tr> <tr><td></td><td></td><td>1195</td><td>w</td></tr> <tr><td></td><td></td><td>1117</td><td>sh</td></tr> <tr><td></td><td>D₁</td><td>1030</td><td>s</td></tr> <tr><td></td><td></td><td>985</td><td>m</td></tr> <tr><td>D</td><td></td><td>907</td><td></td></tr> <tr><td></td><td></td><td>505</td><td>mw</td></tr> <tr><td></td><td>D₂</td><td>470</td><td>s</td></tr> <tr><td></td><td></td><td>423</td><td>mw</td></tr> </table>	A	A ₁	3622	ms			3557	ms		A ₂	3440	sh		A ₃	3300	sh	B	B ₂	1660	m			1195	w			1117	sh		D ₁	1030	s			985	m	D		907				505	mw		D ₂	470	s			423	mw
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		423	mw																																																					

MINERAL NAME SEPIOLITE	SUB GROUP	GROUP SEPIOLITE -PALYGORSKITE	CLASS PHYLLOSILICATES*	SPECTRA NO A158																																																										
CHEMICAL FORMULA (IDEAL) $Mg_4(Si_{16}O_{15})(OH)_2 \cdot 6H_2O$		CHEMICAL FORMULA (ACTUAL)																																																												
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Pnma	a: ≈ 5.28 $\alpha:$	b: ≈ 26.95 $\beta:$	c: ≈ 13.37 $\gamma:$																																																										
ORIGIN OF SAMPLE Eskimi-Sher, ASIA MINOR		REMARKS		PARTICLE SIZE 1 mg																																																										
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																											
			<table border="0"> <tr> <td>A₁</td> <td>3698</td> <td rowspan="2">sh</td> <td rowspan="2">mw</td> </tr> <tr> <td></td> <td>3620</td> </tr> <tr> <td>A₂</td> <td>3580</td> <td rowspan="2">m</td> <td rowspan="2">ms</td> </tr> <tr> <td></td> <td>3435</td> </tr> <tr> <td>A₃</td> <td>3250</td> <td>sh</td> <td>w</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1662</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>1211</td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>1065</td> <td rowspan="2">sh</td> </tr> <tr> <td></td> <td></td> <td>1020</td> </tr> <tr> <td></td> <td></td> <td>980</td> <td>sh</td> </tr> <tr> <td>D</td> <td></td> <td>785</td> <td>w</td> </tr> <tr> <td></td> <td>D₂</td> <td>690</td> <td rowspan="2">mw</td> </tr> <tr> <td></td> <td></td> <td>645</td> </tr> <tr> <td></td> <td></td> <td>520</td> <td>sh</td> </tr> <tr> <td></td> <td>D₃</td> <td>467</td> <td rowspan="2">s</td> </tr> <tr> <td></td> <td></td> <td>435</td> </tr> <tr> <td></td> <td></td> <td>360</td> <td>mw</td> </tr> </table>		A ₁	3698	sh	mw		3620	A ₂	3580	m	ms		3435	A ₃	3250	sh	w	B	B ₂	1662	ms			1211	ms		D ₁	1065	sh			1020			980	sh	D		785	w		D ₂	690	mw			645			520	sh		D ₃	467	s			435	
A ₁	3698	sh	mw																																																											
	3620																																																													
A ₂	3580	m	ms																																																											
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A ₃	3250	sh	w																																																											
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D		785	w																																																											
	D ₂	690	mw																																																											
		645																																																												
		520	sh																																																											
	D ₃	467	s																																																											
		435																																																												
		360	mw																																																											

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: $\alpha:$	b: $\beta:$	c: $\gamma:$
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.																																										
APOPHYLLITE			PHYLLOSILICATES	A161																																										
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																												
KCa ₄ [Si ₈ O ₂₀](F,OH)·8H ₂ O																																														
CRYSTAL SYSTEM	SPACE GROUP	a: 8.96	b:	c: 15.767																																										
TETRAGONAL	P4/mnc (128)	α:	β:	γ:																																										
				Z: 2																																										
				D: 2.380																																										
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																										
Lambert Quarry, OREGON, USA				2 mg																																										
				MAJOR ABSORPTION BANDS (cm⁻¹)																																										
				<table><tr><td>A₂</td><td>3567</td><td>ms</td></tr><tr><td>A₃</td><td>3395</td><td>mw</td></tr><tr><td>A₄</td><td>3068</td><td>m</td></tr><tr><td>B₂</td><td>1695</td><td>m</td></tr><tr><td rowspan="4">D₁</td><td>1124</td><td>mw</td></tr><tr><td>1093</td><td>mw</td></tr><tr><td>1041</td><td>sh</td></tr><tr><td>1010</td><td>s</td></tr><tr><td rowspan="4">D₂</td><td>790</td><td>sh</td></tr><tr><td>765</td><td>ms</td></tr><tr><td>708</td><td>w</td></tr><tr><td>600</td><td>m</td></tr><tr><td rowspan="4">D₃</td><td>520</td><td>w</td></tr><tr><td>500</td><td>ms</td></tr><tr><td>475</td><td></td><td></td></tr><tr><td>407</td><td>mw</td></tr><tr><td></td><td>350</td><td>mw</td></tr><tr><td></td><td>303</td><td></td></tr></table>	A ₂	3567	ms	A ₃	3395	mw	A ₄	3068	m	B ₂	1695	m	D ₁	1124	mw	1093	mw	1041	sh	1010	s	D ₂	790	sh	765	ms	708	w	600	m	D ₃	520	w	500	ms	475			407	mw		350
A ₂	3567	ms																																												
A ₃	3395	mw																																												
A ₄	3068	m																																												
B ₂	1695	m																																												
D ₁	1124	mw																																												
	1093	mw																																												
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	1010	s																																												
D ₂	790	sh																																												
	765	ms																																												
	708	w																																												
	600	m																																												
D ₃	520	w																																												
	500	ms																																												
	475																																													
	407	mw																																												
	350	mw																																												
	303																																													

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.																																																				
PREHNITE				A163																																																				
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																						
Ca ₂ Al ₂ Si ₃ O ₁₀ (OH) ₂																																																								
CRYSTAL SYSTEM	SPACE GROUP	a: 4.61	b: 5.47	c: 18.48																																																				
ORTHORHOMBIC	P2cm (28)	α:	β:	γ:																																																				
				Z: 2																																																				
				D: 2.94																																																				
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE																																																				
Morka Near Čáslav, BOHEMIA CSSR				CONC																																																				
				2 mg																																																				
				MAJOR ABSORPTION BANDS (cm ⁻¹)																																																				
				<table><tr><td>A</td><td>A₂</td><td>3487</td><td>s</td></tr><tr><td></td><td></td><td>1087</td><td>m</td></tr><tr><td></td><td></td><td>1069</td><td>m</td></tr><tr><td></td><td>D₁</td><td>994</td><td>s</td></tr><tr><td></td><td></td><td>933</td><td>m</td></tr><tr><td></td><td></td><td>867</td><td>mw</td></tr><tr><td></td><td></td><td>810</td><td>m</td></tr><tr><td>D</td><td>D₂</td><td>741</td><td>ms</td></tr><tr><td></td><td></td><td>665</td><td>w</td></tr><tr><td></td><td></td><td>526</td><td>s</td></tr><tr><td></td><td></td><td>468</td><td></td></tr><tr><td></td><td>D₃</td><td>419</td><td>ms</td></tr><tr><td></td><td></td><td>374</td><td>m</td></tr><tr><td></td><td></td><td>339</td><td>ms</td></tr></table>	A	A ₂	3487	s			1087	m			1069	m		D ₁	994	s			933	m			867	mw			810	m	D	D ₂	741	ms			665	w			526	s			468			D ₃	419	ms			374	m
A	A ₂	3487	s																																																					
		1087	m																																																					
		1069	m																																																					
	D ₁	994	s																																																					
		933	m																																																					
		867	mw																																																					
		810	m																																																					
D	D ₂	741	ms																																																					
		665	w																																																					
		526	s																																																					
		468																																																						
	D ₃	419	ms																																																					
		374	m																																																					
		339	ms																																																					

MINERAL NAME MAGADIITE	SUB GROUP	GROUP	CLASS	SPECTRA NO A160																																																					
CHEMICAL FORMULA (IDEAL) $\text{NaSi}_7\text{O}_{13}(\text{OH})_3 \cdot 3\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																																							
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP ()	a: 12.620 α:	b: β:	c: 15.573 γ: Z: D:																																																					
ORIGIN OF SAMPLE East Fork Trinity River, Trinity Co., CALIFORNIA, USA	REMARKS		PARTICLE SIZE	CONC 2 mg																																																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																						
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3667</td><td>mw</td></tr> <tr><td></td><td>A₂</td><td>3425</td><td>m</td></tr> <tr><td>B</td><td>B₂</td><td>1630</td><td>mw</td></tr> <tr><td></td><td></td><td>1238</td><td>mw</td></tr> <tr><td></td><td>D₁</td><td>1195</td><td>w</td></tr> <tr><td></td><td></td><td>1075</td><td>s</td></tr> <tr><td></td><td></td><td>1038</td><td>sh</td></tr> <tr><td></td><td></td><td>819</td><td>m</td></tr> <tr><td></td><td>D₂</td><td>779</td><td>ms</td></tr> <tr><td></td><td></td><td>700</td><td>w</td></tr> <tr><td></td><td></td><td>620</td><td>m</td></tr> <tr><td></td><td></td><td>580</td><td>m</td></tr> <tr><td>D₃</td><td></td><td>440</td><td>s</td></tr> <tr><td></td><td></td><td>400</td><td>sh</td></tr> </table>		A	A ₁	3667	mw		A ₂	3425	m	B	B ₂	1630	mw			1238	mw		D ₁	1195	w			1075	s			1038	sh			819	m		D ₂	779	ms			700	w			620	m			580	m	D ₃		440	s	
A	A ₁	3667	mw																																																						
	A ₂	3425	m																																																						
B	B ₂	1630	mw																																																						
		1238	mw																																																						
	D ₁	1195	w																																																						
		1075	s																																																						
		1038	sh																																																						
		819	m																																																						
	D ₂	779	ms																																																						
		700	w																																																						
		620	m																																																						
		580	m																																																						
D ₃		440	s																																																						
		400	sh																																																						

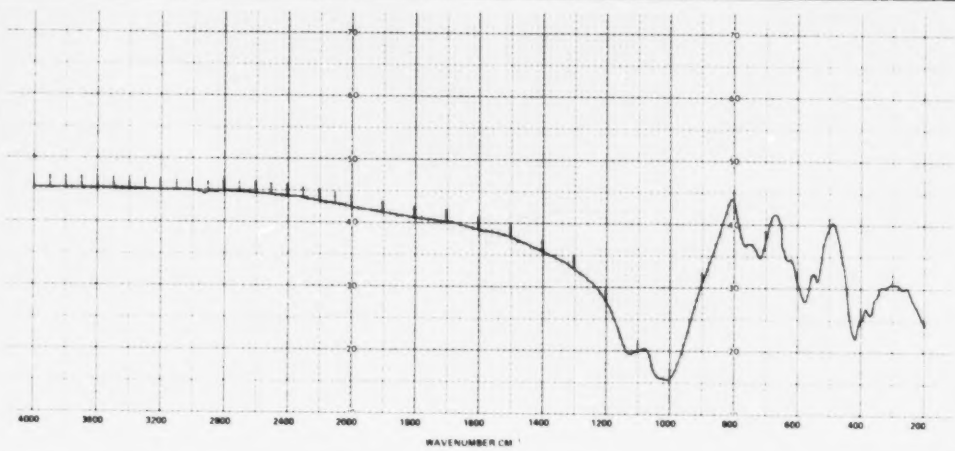
MINERAL NAME CHRYSOCOLLA	SUB GROUP	GROUP	CLASS PHYLLOSILICATES	SPECTRA NO A159																													
CHEMICAL FORMULA (IDEAL) $(\text{Cu}, \text{Al})_2\text{H}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																															
CRYSTAL SYSTEM MONOCLINIC OR ORTHORHOMBIC (?)	SPACE GROUP ()	a: 5.70 α:	b: 8.85 β: ~	c: 6.70 γ: Z: D: 2.2																													
ORIGIN OF SAMPLE Arizona, USA	REMARKS		PARTICLE SIZE	CONC 2 mg																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																														
			<table border="0"> <tr><td>A</td><td>A₁</td><td>3620</td><td>sh</td></tr> <tr><td></td><td>A₂</td><td>3425</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>m</td></tr> <tr><td></td><td>D₁</td><td>1025</td><td>s</td></tr> <tr><td></td><td></td><td>785</td><td>w</td></tr> <tr><td></td><td>D₂</td><td>665</td><td>mw</td></tr> <tr><td>D</td><td></td><td>495</td><td>s</td></tr> <tr><td></td><td>D₃</td><td>450?</td><td></td></tr> </table>		A	A ₁	3620	sh		A ₂	3425	s	B	B ₂	1640	m		D ₁	1025	s			785	w		D ₂	665	mw	D		495	s	
A	A ₁	3620	sh																														
	A ₂	3425	s																														
B	B ₂	1640	m																														
	D ₁	1025	s																														
		785	w																														
	D ₂	665	mw																														
D		495	s																														
	D ₃	450?																															

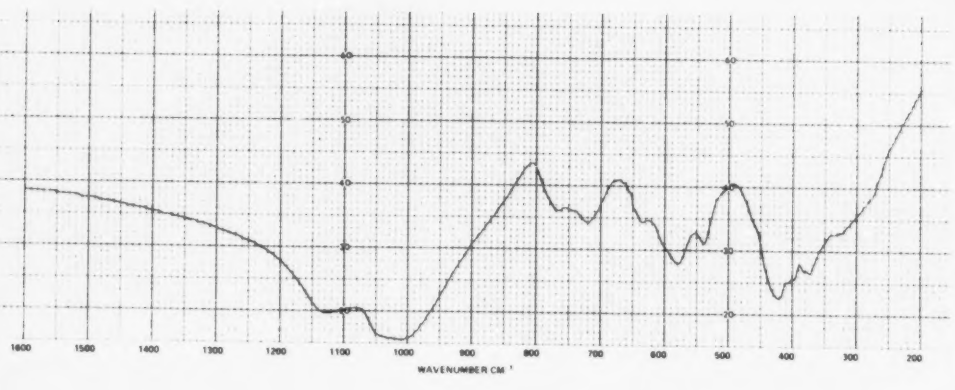
MINERAL NAME MICROCLINE	SUB GROUP ALKALI-FELDSPAR	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 149																																	
CHEMICAL FORMULA (IDEAL) KAlSi₃O₈		CHEMICAL FORMULA (ACTUAL)																																			
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP C₁ (2)	a: 8.581 α: 96.65°	b: 12.961 β: 115.94°	c: 7.223 γ: 87.63°																																	
ORIGIN OF SAMPLE Parry Sound, ONTARIO		REMARKS	PARTICLE SIZE	CONC 0.7 mg																																	
			MAJOR ABSORPTION BANDS (cm⁻¹)																																		
			<table> <tr><td>D₁</td><td>1145</td><td>ms</td></tr> <tr><td></td><td>1087</td><td>ms</td></tr> <tr><td></td><td>1045</td><td>ms</td></tr> <tr><td></td><td>1006</td><td>ms</td></tr> <tr><td>D₂</td><td>766</td><td>mw</td></tr> <tr><td></td><td>721</td><td>mw</td></tr> <tr><td></td><td>642</td><td>mw</td></tr> <tr><td>D₃</td><td>579</td><td>mw</td></tr> <tr><td></td><td>532</td><td>mw</td></tr> <tr><td></td><td>427</td><td>ms</td></tr> <tr><td></td><td>366</td><td>m</td></tr> <tr><td></td><td>319</td><td>mw</td></tr> </table>		D ₁	1145	ms		1087	ms		1045	ms		1006	ms	D ₂	766	mw		721	mw		642	mw	D ₃	579	mw		532	mw		427	ms		366	m
D ₁	1145	ms																																			
	1087	ms																																			
	1045	ms																																			
	1006	ms																																			
D ₂	766	mw																																			
	721	mw																																			
	642	mw																																			
D ₃	579	mw																																			
	532	mw																																			
	427	ms																																			
	366	m																																			
	319	mw																																			

MINERAL NAME MICROCLINE	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 149¹
CHEMICAL FORMULA (IDEAL) KAlSi₃O₈		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: α:	b: β:	c: γ:
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME ORTHOCLASE	SUB GROUP ALKALI (FELDSPAR)	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 145																		
CHEMICAL FORMULA (IDEAL) $KAlSi_3O_8$		CHEMICAL FORMULA (ACTUAL) $K_{0.8}Na_{0.1}Al_{1.1}Si_{3.0}O_{8.0}$ (EDXRA)																				
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $C2/m$ (12)	a: 8.556 b: 12.98 c: 7.205 Z: 4 D: 2.55 $\alpha:$ $\beta: 116^\circ 01'$ $\gamma:$																				
ORIGIN OF SAMPLE Fort Bayard, NEW MEXICO, USA	REMARKS		PARTICLE SIZE	CONC. 0.7 mg																		
			MAJOR ABSORPTION BANDS (cm⁻¹)																			
			<table> <tr> <td rowspan="3">D₁</td> <td>1117</td> <td>ms</td> </tr> <tr> <td>1020</td> <td>ms</td> </tr> <tr> <td>768</td> <td>mw</td> </tr> <tr> <td rowspan="3">D₂</td> <td>720</td> <td>mw</td> </tr> <tr> <td>632</td> <td>sh mw</td> </tr> <tr> <td>580</td> <td>m</td> </tr> <tr> <td rowspan="3">D₃</td> <td>542</td> <td>mw</td> </tr> <tr> <td>422</td> <td>m</td> </tr> <tr> <td>382</td> <td>sh m</td> </tr> </table>		D ₁	1117	ms	1020	ms	768	mw	D ₂	720	mw	632	sh mw	580	m	D ₃	542	mw	422
D ₁	1117	ms																				
	1020	ms																				
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D ₂	720	mw																				
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D ₃	542	mw																				
	422	m																				
	382	sh m																				

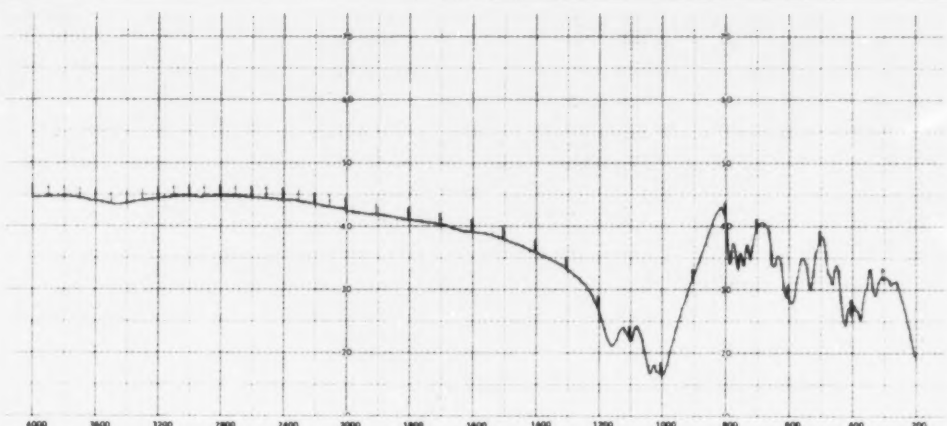
MINERAL NAME ORTHOCLASE	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 145¹
CHEMICAL FORMULA (IDEAL) $KAlSi_3O_8$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: b: c: Z: D: $\alpha:$ $\beta:$ $\gamma:$		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC. mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

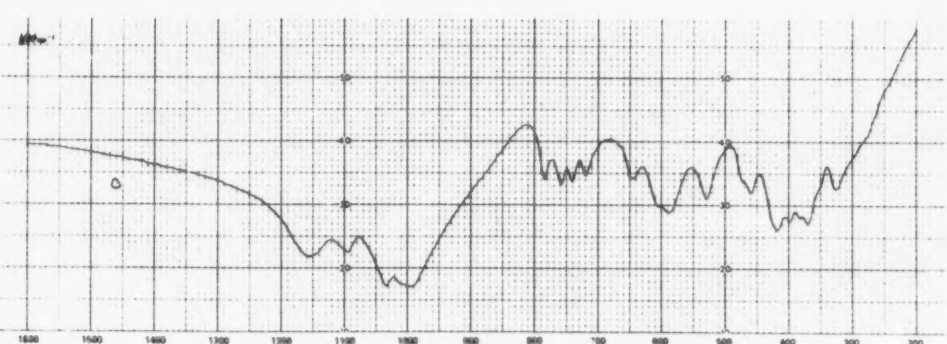
MINERAL NAME ADULARIA	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 146																											
VAR. OF ORTHOCLASE	CHEMICAL FORMULA (IDEAL) $KAlSi_3O_8$		CHEMICAL FORMULA (ACTUAL) $K_{0.83}Na_{0.06}Al_{1.05}Si_{2.99}O_8$ (EDXRA)																												
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP $C2/m$ (12)																														
a: 8.482 b: 12.970 c: 7.183 Z: 4 D: $\alpha:$ $\beta: 115^\circ 59'$ $\gamma:$																															
ORIGIN OF SAMPLE Valhuf Tauesch, SWITZERLAND		REMARKS		PARTICLE SIZE 0.7 mg																											
				MAJOR ABSORPTION BANDS (cm^{-1}) <table border="0"> <tr><td>D_1</td><td>1130</td><td>ms</td></tr> <tr><td></td><td>1008</td><td>ms</td></tr> <tr><td></td><td>765</td><td>mw</td></tr> <tr><td>D_2</td><td>720</td><td>mw</td></tr> <tr><td></td><td>635</td><td>sh mw</td></tr> <tr><td></td><td>580</td><td>mw</td></tr> <tr><td></td><td>540</td><td>mw</td></tr> <tr><td>D_3</td><td>423</td><td>m</td></tr> <tr><td></td><td>373</td><td>m</td></tr> </table>	D_1	1130	ms		1008	ms		765	mw	D_2	720	mw		635	sh mw		580	mw		540	mw	D_3	423	m		373	m
D_1	1130	ms																													
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D_2	720	mw																													
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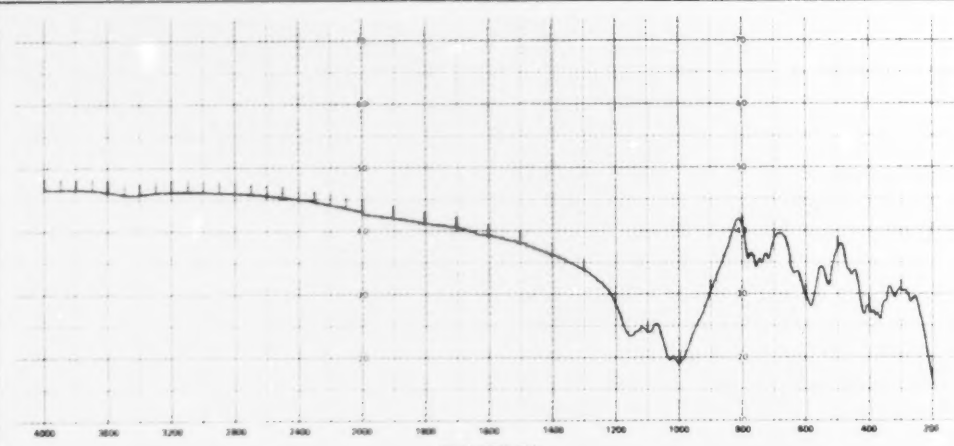
MINERAL NAME ADULARIA	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 146¹
	CHEMICAL FORMULA (IDEAL) $KAlSi_3O_8$		CHEMICAL FORMULA (ACTUAL)	
CRYSTAL SYSTEM	SPACE GROUP			
() a: b: c: Z: D: $\alpha:$ $\beta:$ $\gamma:$				
ORIGIN OF SAMPLE		REMARKS		PARTICLE SIZE mg
				MAJOR ABSORPTION BANDS (cm^{-1})

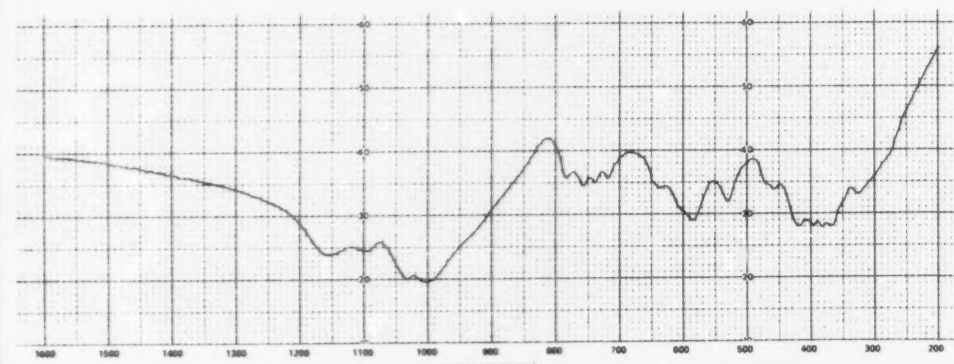
MINERAL NAME ANORTHOCLASE	SUB GROUP ALKALI-FELDSPAR	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO A205																																	
CHEMICAL FORMULA (IDEAL) (Na,K)AlSi₃O₈		CHEMICAL FORMULA (ACTUAL)																																			
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P$\bar{1}$ (2)	a: 7.626 b: 7.626 c: 7.119 Z: 2 α: 100°50' β: 106°47' γ: 115°08'		D: 2.57																																	
ORIGIN OF SAMPLE Larvik, NORWAY	REMARKS	PARTICLE SIZE	CONC 1 mg																																		
		MAJOR ABSORPTION BANDS (cm ⁻¹) <table> <tr> <td>D₁</td> <td>1110</td> <td>ms</td> </tr> <tr> <td></td> <td>1011</td> <td>s</td> </tr> <tr> <td></td> <td>760?</td> <td>sh</td> </tr> <tr> <td>D₂</td> <td>730</td> <td>mw</td> </tr> <tr> <td></td> <td>632</td> <td>m</td> </tr> <tr> <td>D</td> <td>583</td> <td>ms</td> </tr> <tr> <td></td> <td>538</td> <td>m</td> </tr> <tr> <td>D₃</td> <td>423</td> <td>ms</td> </tr> <tr> <td></td> <td>406</td> <td>sh</td> </tr> <tr> <td></td> <td>397</td> <td>ms</td> </tr> <tr> <td></td> <td>383</td> <td>ms</td> </tr> </table>			D ₁	1110	ms		1011	s		760?	sh	D ₂	730	mw		632	m	D	583	ms		538	m	D ₃	423	ms		406	sh		397	ms		383	ms
		D ₁	1110	ms																																	
	1011	s																																			
	760?	sh																																			
D ₂	730	mw																																			
	632	m																																			
D	583	ms																																			
	538	m																																			
D ₃	423	ms																																			
	406	sh																																			
	397	ms																																			
	383	ms																																			

MINERAL NAME ANORTHOCLASE	SUB GROUP ALKALI-FELDSPAR	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO A205¹
CHEMICAL FORMULA (IDEAL) (Na,K)AlSi₃O₈		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a:	b:	c:
		α:	β:	γ:
			Z:	D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm ⁻¹)		

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
ALBITE	PLAGIOCLASE	FELDSPAR	TECTOSILICATES	152
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
$\text{NaAlSi}_3\text{O}_8$ (=Ab)		$(\text{Na}_{0.90}\text{Ca}_{0.02}\text{K}_{0.01})(\text{Al}_{0.99}\text{Fe}_{0.04})\text{Si}_{3.01}\text{O}_{8.00}$		
CRYSTAL SYSTEM (TEMP. LOW FORM) TRICLINIC	SPACE GROUP $\text{P}\bar{1}$ (2)	a: 8.138 α : 94.27°	b: 12.79 β : 116.61°	c: 7.161 γ : 87.69°
Z: 4		D: 2.62		
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC
Keystone, S. DAKOTA, USA				0.7 mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	
			1155 ms 1096 ms D ₁ 1033) ms 995) ms 785 mw 769 mw D ₂ 740 mw 719 mw 645 mw 600) sh mw 587) mw 528 mw D ₃ 470 mw 458 mw 418 m 397 m 370 m 322	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
ALBITE		FELDSPAR	TECTOSILICATES	152 ¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α :	β :	γ :
		Z:		D:
ORIGIN OF SAMPLE		REMARKS	PARTICLE SIZE	CONC
				mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
OLIGOCLASE	PLAGIOCLASE	FELDSPAR	TECTOSILICATES	147
CHEMICAL FORMULA (IDEAL)		Ab ALBITE COMP. An ANORTHITE COMP.	CHEMICAL FORMULA (ACTUAL)	
Ab ₉₀₋₇₀ An ₁₀₋₃₀			(Na _{0.84} Ca _{0.10} K _{0.08})Al _{1.10} Si _{2.89} O ₈ (EDXRA)	
CRYSTAL SYSTEM	SPACE GROUP	a: 8.152 α: 93.99°	b: 12.821 β: 116.46°	c: 7.139 γ: 88.58°
TRICLINIC	cī (2)	Z: 4	D: 2.624	
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
Kragera, NORWAY				0.7 mg
				MAJOR ABSORPTION BANDS
				(cm ⁻¹)
				D ₁ 1153 m
				1092 m
				1030 ms
				1000 ms
				782 mw
				756 mw
				738 mw
				D ₂ 718 mw
				665 w
				637 mw
				585 mw
				530 mw
				457 mw
				D ₃ 428 m
				396 m
				382 m
				368 m
				320 mw

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
OLIGOCLASE		FELDSPAR	TECTOSILICATES	147 ¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α:	β:	γ:
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
				CONC
				mg
				MAJOR ABSORPTION BANDS
				(cm ⁻¹)

MINERAL NAME ANDESINE	SUB GROUP PLAGIOCLASE	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO A207																																								
CHEMICAL FORMULA (IDEAL) Ab₇₀₋₅₀An₃₀₋₅₀		CHEMICAL FORMULA (ACTUAL) Na_{0.56}Ca_{0.29}Al_{1.29}Si_{2.75}O₈ (EDXRA)																																										
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP C₂/c	a: 8.164 b: 12.857 c: 7.118 α: 93.69° β: 116.34° γ: 89.59° Z: 4 D: 2.667																																										
ORIGIN OF SAMPLE Palmietfontein, TRANSVAAL	REMARKS		PARTICLE SIZE	CONC 1 mg																																								
			MAJOR ABSORPTION BANDS (cm⁻¹) <table> <tr><td>D₁</td><td>1146</td><td>)</td><td>s</td></tr> <tr><td></td><td>1100</td><td></td><td>s</td></tr> <tr><td></td><td>1000</td><td></td><td>s</td></tr> <tr><td>D₂</td><td>751</td><td></td><td>mw</td></tr> <tr><td></td><td>627</td><td>)</td><td>sh m</td></tr> <tr><td></td><td>580</td><td></td><td>ms</td></tr> <tr><td></td><td>536</td><td></td><td>ms</td></tr> <tr><td>D₃</td><td>460</td><td></td><td>m</td></tr> <tr><td></td><td>420</td><td></td><td>ms</td></tr> <tr><td></td><td>394</td><td></td><td>ms</td></tr> </table>		D ₁	1146	)	s		1100		s		1000		s	D ₂	751		mw		627	)	sh m		580		ms		536		ms	D ₃	460		m		420		ms		394		ms
D ₁	1146	)	s																																									
	1100		s																																									
	1000		s																																									
D ₂	751		mw																																									
	627	)	sh m																																									
	580		ms																																									
	536		ms																																									
D ₃	460		m																																									
	420		ms																																									
	394		ms																																									

MINERAL NAME ANDESINE	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO A207¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: b: c: Z: D: α: β: γ:		
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm⁻¹)	

MINERAL NAME LABRADORITE	SUB GROUP PLAGIOCLASE	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 153																								
CHEMICAL FORMULA (IDEAL) Ab₅₀₋₃₀An₅₀₋₇₀		CHEMICAL FORMULA (ACTUAL) (Ca_{0.48}Na_{0.45}K_{0.16})Al_{1.35}Si_{2.59}O₈ (EDXRA)																										
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP C$\bar{1}$ (2)	a: 8.1648 b: 12.8585 c: 7.0973 α: 93°34' β: 116°06' γ: 89°47' Z: 4 D: 2.685																										
ORIGIN OF SAMPLE Tahawns, NEW YORK, USA	REMARKS	PARTICLE SIZE	CONC 0.7 mg																									
		MAJOR ABSORPTION BANDS (cm ⁻¹)																										
		<table> <tr><td></td><td>1135</td><td>m</td></tr> <tr><td rowspan="3">D₁</td><td>1095</td><td>m</td></tr> <tr><td>995</td><td>ms</td></tr> <tr><td>740</td><td>w</td></tr> <tr><td rowspan="2">D₂</td><td>618</td><td>sh mw</td></tr> <tr><td>579</td><td>m</td></tr> <tr><td rowspan="5">D₃</td><td>540</td><td>mw</td></tr> <tr><td>460</td><td>sh mw</td></tr> <tr><td>420</td><td>sh mw</td></tr> <tr><td>383</td><td>m</td></tr> <tr><td>373</td><td>m</td></tr> </table>				1135	m	D ₁	1095	m	995	ms	740	w	D ₂	618	sh mw	579	m	D ₃	540	mw	460	sh mw	420	sh mw	383	m
	1135	m																										
D ₁	1095	m																										
	995	ms																										
	740	w																										
D ₂	618	sh mw																										
	579	m																										
D ₃	540	mw																										
	460	sh mw																										
	420	sh mw																										
	383	m																										
	373	m																										

MINERAL NAME LABRADORITE	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 153¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: b: c: Z: D: α: β: γ:		
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm ⁻¹)		

MINERAL NAME BYTOWNITE	SUB GROUP PLAGIOCLASE	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 158																																										
CHEMICAL FORMULA (IDEAL) Ab ₃₀₋₁₀ An ₇₀₋₉₀		CHEMICAL FORMULA (ACTUAL) (Ca _{0.67} Na _{0.26} Mg _{0.03})Al _{1.87} Fe _{0.02} Si _{2.16} O ₈ (EDXRA)																																												
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P $\bar{1}$ (2)	a: 8.19 b: 12.88 c: 7.11 α : 93°13' β : 116°18' γ : 90°35' Z: 4 D: 2.718																																												
ORIGIN OF SAMPLE Crystal Bay, MINNESOTA, USA	REMARKS	PARTICLE SIZE	CONC 0.7 mg																																											
		MAJOR ABSORPTION BANDS (cm⁻¹)																																												
		<table border="0"> <tr><td></td><td>1142</td><td>)</td><td>m</td></tr> <tr><td></td><td>1093</td><td>)</td><td>m</td></tr> <tr><td>D₁</td><td>982</td><td>)</td><td>ms</td></tr> <tr><td></td><td>936</td><td>)</td><td>ms</td></tr> <tr><td>D</td><td>750</td><td>)</td><td></td></tr> <tr><td>D₂</td><td>730</td><td>)</td><td>mW</td></tr> <tr><td></td><td>628</td><td>)</td><td>m</td></tr> <tr><td></td><td>575</td><td>)</td><td>m</td></tr> <tr><td>D₃</td><td>548</td><td>)</td><td>m</td></tr> <tr><td></td><td>466</td><td>)</td><td>mW</td></tr> <tr><td></td><td>378</td><td>)</td><td>m</td></tr> </table>				1142	)	m		1093	)	m	D ₁	982	)	ms		936	)	ms	D	750	)		D ₂	730	)	mW		628	)	m		575	)	m	D ₃	548	)	m		466	)	mW		378
	1142	)	m																																											
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D ₃	548	)	m																																											
	466	)	mW																																											
	378	)	m																																											

MINERAL NAME BYTOWNITE	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 158 ¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: b: c: Z: D: α : β : γ :		
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		

MINERAL NAME ANORTHITE	SUB GROUP PLAGIOCLASE	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 159																														
CHEMICAL FORMULA (IDEAL) CaAl₂Si₂O₈ (=An)		CHEMICAL FORMULA (ACTUAL) Ca_{1.03}Al_{1.89}Fe_{0.04}Si_{2.04}O₈ (EDXRA)																																
CRYSTAL SYSTEM TRICLINIC	SPACE GROUP P1 (2)	a: 8.184 b: 12.865 c: 14.150 α: 92.28° β: 115.92° γ: 91.62°		Z: 8 D: 27.592																														
ORIGIN OF SAMPLE Grass Valley, CALIFORNIA, USA	REMARKS		PARTICLE SIZE	CONC 0.7mg																														
			MAJOR ABSORPTION BANDS (cm ⁻¹)																															
			<table border="0"> <tr><td></td><td>1142</td><td>ms</td></tr> <tr><td rowspan="3">D₁</td><td>1078</td><td>m</td></tr> <tr><td>1020</td><td>ms</td></tr> <tr><td>928</td><td>ms</td></tr> <tr><td rowspan="3">D</td><td>753</td><td>mw</td></tr> <tr><td>726</td><td>mw</td></tr> <tr><td>678</td><td>sh mw</td></tr> <tr><td rowspan="3">D₂</td><td>661</td><td>mw</td></tr> <tr><td>628</td><td>m</td></tr> <tr><td>569</td><td>m</td></tr> <tr><td rowspan="4">D₃</td><td>536</td><td>m</td></tr> <tr><td>466</td><td>mw</td></tr> <tr><td>372</td><td>m</td></tr> <tr><td>347</td><td>m</td></tr> </table>			1142	ms	D ₁	1078	m	1020	ms	928	ms	D	753	mw	726	mw	678	sh mw	D ₂	661	mw	628	m	569	m	D ₃	536	m	466	mw	372
	1142	ms																																
D ₁	1078	m																																
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D	753	mw																																
	726	mw																																
	678	sh mw																																
D ₂	661	mw																																
	628	m																																
	569	m																																
D ₃	536	m																																
	466	mw																																
	372	m																																
	347	m																																

MINERAL NAME ANORTHITE	SUB GROUP	GROUP FELDSPAR	CLASS TECTOSILICATES	SPECTRA NO 159¹
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP ()	a: b: c: α: β: γ:	Z:	D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME QUARTZ	SUB GROUP	GROUP	CLASS TECTOSILICATES	SPECTRA NO. A204																								
CHEMICAL FORMULA (IDEAL) SiO₂		CHEMICAL FORMULA (ACTUAL)																										
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP P3₁21 (152)	a: 4.903093 b: 5.393673 α: β: γ: Z: 3		D: 2.665																								
ORIGIN OF SAMPLE BRAZIL	REMARKS a. = 4.910+10 c = 5.394+10, Z=3 with P3 ₁ 21		PARTICLE SIZE	CONC 0.5 mg																								
			MAJOR ABSORPTION BANDS (cm⁻¹)																									
			<table> <tr> <td>D₁</td> <td>1168) sh</td> <td>mw</td> </tr> <tr> <td></td> <td>1080)</td> <td>s</td> </tr> <tr> <td></td> <td>797)</td> <td></td> </tr> <tr> <td>D₂</td> <td>778)</td> <td>s</td> </tr> <tr> <td></td> <td>692)</td> <td>m</td> </tr> <tr> <td></td> <td>509)</td> <td>ms</td> </tr> <tr> <td></td> <td>460)</td> <td>s</td> </tr> <tr> <td>D₃</td> <td>393)</td> <td>ms</td> </tr> <tr> <td></td> <td>368)</td> <td>ms</td> </tr> </table>		D ₁	1168) sh	mw		1080)	s		797)		D ₂	778)	s		692)	m		509)	ms		460)	s	D ₃	393)	ms
D ₁	1168) sh	mw																										
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D ₂	778)	s																										
	692)	m																										
	509)	ms																										
	460)	s																										
D ₃	393)	ms																										
	368)	ms																										

MINERAL NAME TRIDYMITE	SUB GROUP	GROUP	CLASS TECTOSILICATES	SPECTRA NO. B199												
CHEMICAL FORMULA (IDEAL) SiO₂		CHEMICAL FORMULA (ACTUAL)														
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP ()	a: 30.08 b: 49.08 α: β: γ: Z: 864		D: 2.241												
ORIGIN OF SAMPLE Kusatsu, Gunma Pref. JAPAN	REMARKS		PARTICLE SIZE 0.5-2 μm	CONC 0.25 mg												
			MAJOR ABSORPTION BANDS (cm⁻¹)													
			<table> <tr> <td>D₁</td> <td>1155) sh</td> <td></td> </tr> <tr> <td></td> <td>1105)</td> <td>vs</td> </tr> <tr> <td>D₂</td> <td>788)</td> <td>ms</td> </tr> <tr> <td></td> <td>525) sh</td> <td></td> </tr> <tr> <td>D₃</td> <td>482)</td> <td>s</td> </tr> </table>		D ₁	1155) sh			1105)	vs	D ₂	788)	ms		525) sh	
D ₁	1155) sh															
	1105)	vs														
D ₂	788)	ms														
	525) sh															
D ₃	482)	s														

MINERAL NAME OPAL	SUB GROUP	GROUP	CLASS TECTOSILICATES	SPECTRA NO. A172																	
CHEMICAL FORMULA (IDEAL) $\text{SiO}_2 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																			
CRYSTAL SYSTEM NONCRYSTALLINE	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:																	
ORIGIN OF SAMPLE Queensland, AUSTRALIA	REMARKS		PARTICLE SIZE	CONC. 1 mg																	
			MAJOR ABSORPTION BANDS (cm⁻¹)																		
			<table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3450</td> <td>mw</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1620</td> <td>w</td> </tr> <tr> <td rowspan="2">D</td> <td rowspan="2"></td> <td>1180</td> <td>sh mw</td> </tr> <tr> <td>1095</td> <td>s</td> </tr> <tr> <td rowspan="2">D</td> <td rowspan="2"></td> <td>786</td> <td>ms</td> </tr> <tr> <td>471</td> <td>s</td> </tr> </table>		A	A₂	3450	mw	B	B₂	1620	w	D		1180	sh mw	1095	s	D		786
A	A₂	3450	mw																		
B	B₂	1620	w																		
D		1180	sh mw																		
		1095	s																		
D		786	ms																		
		471	s																		

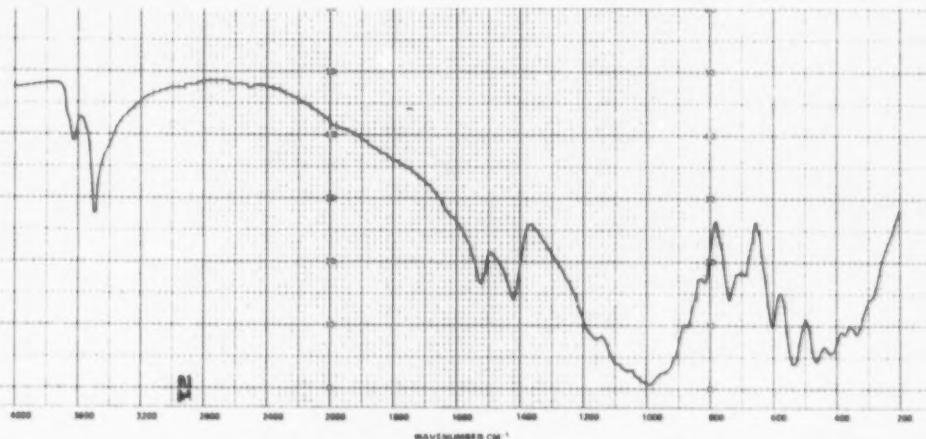
MINERAL NAME OBSIDIAN	SUB GROUP	GROUP	CLASS	SPECTRA NO. A171																					
CHEMICAL FORMULA (IDEAL) VOLCANIC GLASS		CHEMICAL FORMULA (ACTUAL)																							
CRYSTAL SYSTEM NONCRYSTALLINE	SPACE GROUP ()	a: α:	b: β:	c: γ: Z: D:																					
ORIGIN OF SAMPLE Little Lake, CALIFORNIA, USA	REMARKS		PARTICLE SIZE	CONC. 1 mg																					
			MAJOR ABSORPTION BANDS (cm⁻¹)																						
			<table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3435</td> <td>mw</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1624</td> <td>w</td> </tr> <tr> <td rowspan="2">D</td> <td rowspan="2"></td> <td>1180</td> <td>sh ms</td> </tr> <tr> <td>1063</td> <td>s</td> </tr> <tr> <td rowspan="2">D</td> <td rowspan="2"></td> <td>781</td> <td>mw</td> </tr> <tr> <td>730</td> <td>sh w</td> </tr> <tr> <td>D₃</td> <td></td> <td>458</td> <td>s</td> </tr> </table>		A	A₂	3435	mw	B	B₂	1624	w	D		1180	sh ms	1063	s	D		781	mw	730	sh w	D₃
A	A₂	3435	mw																						
B	B₂	1624	w																						
D		1180	sh ms																						
		1063	s																						
D		781	mw																						
		730	sh w																						
D₃		458	s																						

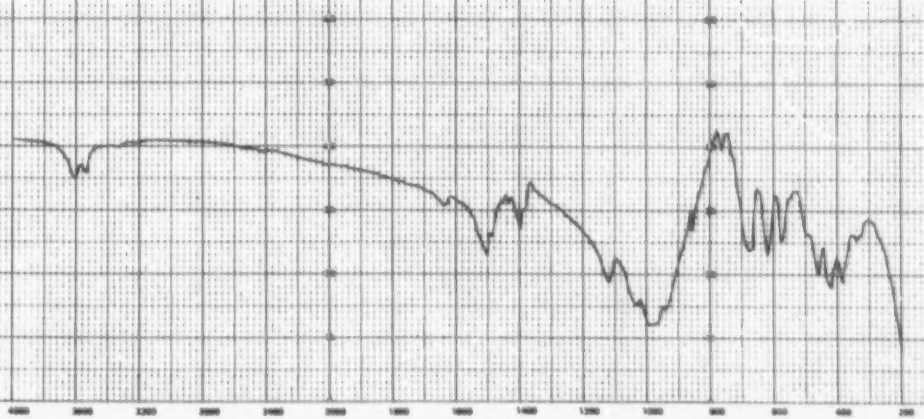
MINERAL NAME NEPHELINE	SUB GROUP	GROUP NEPHELINE	CLASS TECTOSILICATES	SPECTRA NO A284															
CHEMICAL FORMULA (IDEAL) (Na,K)AlSiO₄		CHEMICAL FORMULA (ACTUAL)																	
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP P6₃ (173)	a: 10.01 α:	b: β:	c: 8.405 γ: Z: 8 D: 2.66															
ORIGIN OF SAMPLE GSC 60259	REMARKS		PARTICLE SIZE	CONC 2 mg															
			MAJOR ABSORPTION BANDS (cm⁻¹)																
			<table> <tr><td>D₁</td><td>988</td><td>s</td></tr> <tr><td>D₂</td><td>688</td><td>s</td></tr> <tr><td>D</td><td>571</td><td>sh w</td></tr> <tr><td></td><td>506</td><td>ms</td></tr> <tr><td>D₃</td><td>467</td><td>s</td></tr> <tr><td></td><td>407</td><td>sh w</td></tr> </table>		D ₁	988	s	D ₂	688	s	D	571	sh w		506	ms	D ₃	467	s
D ₁	988	s																	
D ₂	688	s																	
D	571	sh w																	
	506	ms																	
D ₃	467	s																	
	407	sh w																	

MINERAL NAME LEUCITE	SUB GROUP	GROUP	CLASS TECTOSILICATES	SPECTRA NO A77															
CHEMICAL FORMULA (IDEAL) KAlSi₂O₆		CHEMICAL FORMULA (ACTUAL)																	
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP 14₁/a (88)	a: 13.060 α:	b: β:	c: 13.751 γ: Z: 16 D: 2.472															
ORIGIN OF SAMPLE Miyakejima, JAPAN	REMARKS		PARTICLE SIZE	CONC 2 mg															
			MAJOR ABSORPTION BANDS (cm⁻¹)																
			<table> <tr><td>D₁</td><td>1020</td><td>s</td></tr> <tr><td></td><td>750</td><td>sh m</td></tr> <tr><td>D₂</td><td>709</td><td>ms</td></tr> <tr><td></td><td>631</td><td>mw</td></tr> <tr><td></td><td>536</td><td>w</td></tr> <tr><td>D₃</td><td>427</td><td>s</td></tr> </table>		D ₁	1020	s		750	sh m	D ₂	709	ms		631	mw		536	w
D ₁	1020	s																	
	750	sh m																	
D ₂	709	ms																	
	631	mw																	
	536	w																	
D ₃	427	s																	

MINERAL NAME POLLUCITE	SUB GROUP ANALCIME- POLLUCITE SERIES	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO A83																									
CHEMICAL FORMULA (IDEAL) $(\text{Cs}, \text{Na})_2 (\text{Al}_2 \text{Si}_4) \text{O}_{12} \cdot \text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																											
CRYSTAL SYSTEM CUBIC	SPACE GROUP Ia3d (230)	a: 13.63 α:	b: β:	c: γ: Z: 8 D: 2.95																									
ORIGIN OF SAMPLE Bernic Lake, MANITOBA	REMARKS		PARTICLE SIZE	CONC 1 mg																									
			MAJOR ABSORPTION BANDS (cm ⁻¹)																										
			<table border="1"> <tbody> <tr> <td>A</td> <td>A₁</td> <td>3679</td> <td>W</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1626</td> <td>W</td> </tr> <tr> <td></td> <td>D₁</td> <td>1027</td> <td>S</td> </tr> <tr> <td></td> <td></td> <td>760</td> <td>MS</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>727</td> <td>MS</td> </tr> <tr> <td></td> <td></td> <td>618</td> <td>W</td> </tr> <tr> <td></td> <td>D₃</td> <td>438</td> <td>S</td> </tr> </tbody> </table>		A	A ₁	3679	W	B	B ₂	1626	W		D ₁	1027	S			760	MS	D	D ₂	727	MS			618	W	
A	A ₁	3679	W																										
B	B ₂	1626	W																										
	D ₁	1027	S																										
		760	MS																										
D	D ₂	727	MS																										
		618	W																										
	D ₃	438	S																										

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a: α:	b: β:	c: γ: Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm ⁻¹)	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																													
SCAPOLITE		SCAPOLITE	TECTOSILICATES	A291																																																													
MEIONITE MARIALITE	CHEMICAL FORMULA (IDEAL) (Na,Ca,K) ₄ Al ₃ (Al,Si) ₃ Si ₆ O ₂₄ (Cl,SO ₄ ,CO ₃)		CHEMICAL FORMULA (ACTUAL)																																																														
CRYSTAL SYSTEM TETRAGONAL	SPACE GROUP P4/m (83)	a: 12.055 α:	b: β:	c: 7.51 γ: Z: 2 D: 2.571																																																													
ORIGIN OF SAMPLE GSC 61109 (GREEN)	REMARKS		PARTICLE SIZE	CONC 2 mg																																																													
			MAJOR ABSORPTION BANDS (cm⁻¹)																																																														
			<table><tr><td>A</td><td>A₁</td><td>3627</td><td>m</td></tr><tr><td></td><td>A₂</td><td>3500</td><td>ms</td></tr><tr><td>C</td><td></td><td>1524</td><td>m</td></tr><tr><td></td><td></td><td>1421</td><td>ms</td></tr><tr><td>D₁</td><td></td><td>1160</td><td>w</td></tr><tr><td></td><td></td><td>995</td><td>s</td></tr><tr><td></td><td></td><td>871</td><td>w</td></tr><tr><td></td><td></td><td>815</td><td>w</td></tr><tr><td></td><td></td><td>739</td><td>ms</td></tr><tr><td>D₂</td><td></td><td>690</td><td>m</td></tr><tr><td>D</td><td></td><td>602</td><td>ms</td></tr><tr><td></td><td></td><td>535</td><td>s</td></tr><tr><td>D₃</td><td></td><td>463</td><td>ms</td></tr><tr><td></td><td></td><td>419</td><td>ms</td></tr><tr><td></td><td></td><td>317</td><td>mw</td></tr><tr><td></td><td></td><td>338</td><td>mw</td></tr></table>		A	A ₁	3627	m		A ₂	3500	ms	C		1524	m			1421	ms	D ₁		1160	w			995	s			871	w			815	w			739	ms	D ₂		690	m	D		602	ms			535	s	D ₃		463	ms			419	ms			317	mw	
A	A ₁	3627	m																																																														
	A ₂	3500	ms																																																														
C		1524	m																																																														
		1421	ms																																																														
D ₁		1160	w																																																														
		995	s																																																														
		871	w																																																														
		815	w																																																														
		739	ms																																																														
D ₂		690	m																																																														
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		419	ms																																																														
		317	mw																																																														
		338	mw																																																														

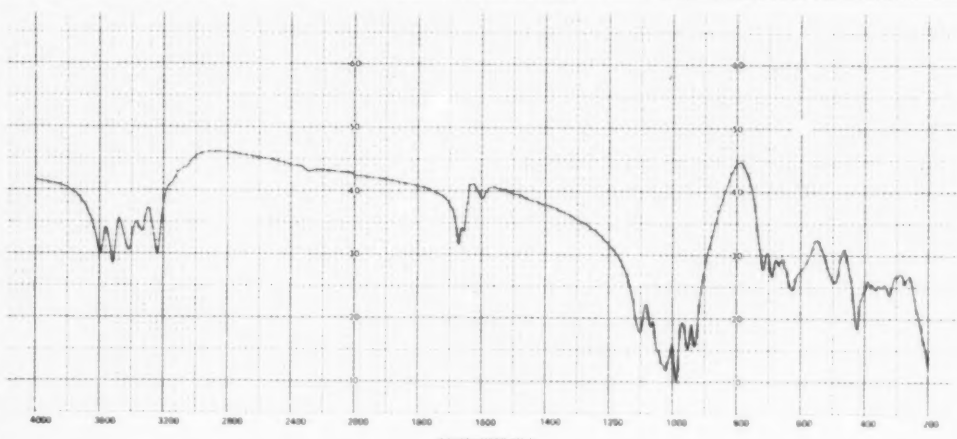
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CANCRINITE		CANCRINITE	TECTOSILICATES	A75
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
(Na,K,Ca) ₆₋₈ (Al,Si) ₁₂ O ₂₄ (SO ₄ ,CO ₃ ,Cl) ₁₋₂ ·nH ₂ O				
CRYSTAL SYSTEM	SPACE GROUP	a: 12.75±2 β:	c: 5.14±3 γ:	Z: 1 D: 2.268
HEXAGONAL	P6 ₃ (173)			
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE
Princess Mine, Bancroft, ONTARIO				2 mg
				
MAJOR ABSORPTION BANDS				
(cm ⁻¹)				
A	A ₂	3610	mw	
		3542	mw	
B	B ₂	1632	w	
		1500	mw	
C		1480	sh w	
		1396	mw	
		1380	sh w	
		1116	mw	
		1028	w	
D ₁		980	s	
		925	w	
		852	mw	
D	D ₂	761	w	
		671	ms	
		617	ms	
		571	ms	
D ₃		458	mw	
		424	mw	

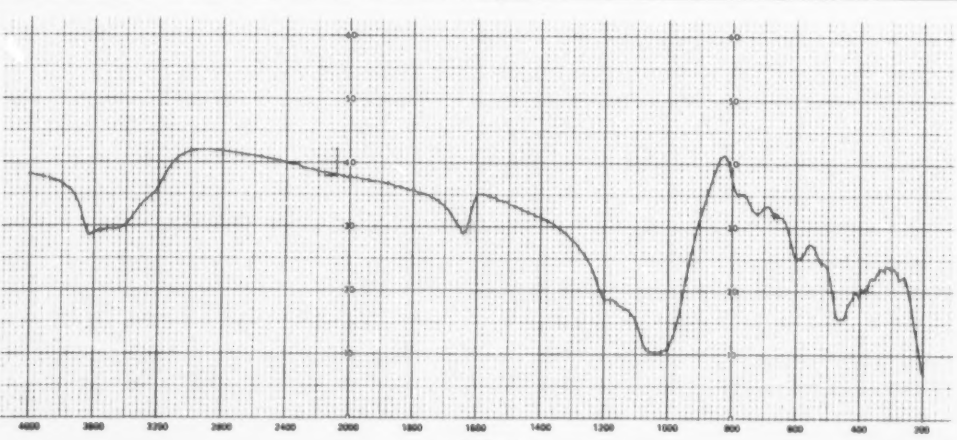
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																								
SODALITE		SODALITE	TECTOSILICATES	A79																								
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																										
$\text{Na}_4\text{Al}_3(\text{SiO}_4)_3\text{Cl}$ OR $\text{Na}_4(\text{Al}_3\text{Si}_3\text{O}_{12})\text{Cl}$																												
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																								
CUBIC	$P\bar{4}3n$ (218)	8.888																										
	$\alpha:$	$\beta:$	$\gamma:$	Z: 2 D: 2.290																								
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC.																									
Princess, Mine, Bancroft, ONTARIO			2 mg																									
		MAJOR ABSORPTION BANDS (cm⁻¹)																										
		<table> <tr> <td>D₁</td> <td>1012</td> <td rowspan="2">) sh</td> <td></td> </tr> <tr> <td></td> <td>980</td> <td>S</td> </tr> <tr> <td></td> <td>731</td> <td></td> <td>S</td> </tr> <tr> <td>D₂</td> <td>708</td> <td rowspan="2">) ms</td> <td></td> </tr> <tr> <td></td> <td>662</td> <td>S</td> </tr> <tr> <td></td> <td>461</td> <td></td> <td>S</td> </tr> <tr> <td>D₃</td> <td>431</td> <td></td> <td>S</td> </tr> </table>			D ₁	1012	) sh			980	S		731		S	D ₂	708	) ms			662	S		461		S	D ₃	431
D ₁	1012	) sh																										
	980		S																									
	731		S																									
D ₂	708	) ms																										
	662		S																									
	461		S																									
D ₃	431		S																									

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()			
	$\alpha:$	$\beta:$	$\gamma:$	Z: D:
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE	CONC.	
			mg	
		MAJOR ABSORPTION BANDS (cm⁻¹)		

MINERAL NAME ANALCIME	SUB GROUP ANALCITE- POLLUCITE SERIES	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO. A82																																			
ANALCITE		CHEMICAL FORMULA (IDEAL) $\text{Na}(\text{AlSi}_2)_6 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																			
CRYSTAL SYSTEM CUBIC	SPACE GROUP Ia3d (230) a: 13.712 b: c: Z: 16 D: 2.268 α: β: γ:																																						
ORIGIN OF SAMPLE Maze, Niigata, JAPAN	REMARKS		PARTICLE SIZE	CONC. 1 mg																																			
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																				
			<table border="0"> <tr> <td>A</td> <td>A₁</td> <td>3630</td> <td rowspan="2">) sh</td> <td rowspan="2">mw</td> </tr> <tr> <td></td> <td>A₂</td> <td>3565</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1640</td> <td></td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1020</td> <td></td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>761</td> <td></td> <td></td> </tr> <tr> <td>D</td> <td>D₂</td> <td>733</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>620</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td>D₃</td> <td>440</td> <td></td> <td>s</td> </tr> </table>		A	A ₁	3630	) sh	mw		A ₂	3565	B	B ₂	1640		mw		D ₁	1020		s			761			D	D ₂	733		ms			620		w		D ₃
A	A ₁	3630	) sh	mw																																			
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B	B ₂	1640		mw																																			
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D	D ₂	733		ms																																			
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	D ₃	440		s																																			

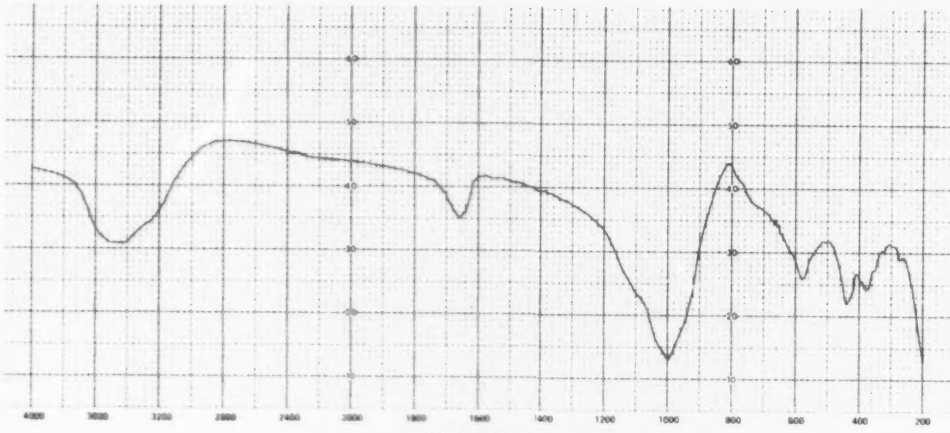
MINERAL NAME NATROLITE	SUB GROUP	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO. A89																																								
		CHEMICAL FORMULA (IDEAL) $\text{Na}_2(\text{Al}_2\text{Si}_3)_6 \cdot 10 \cdot 2\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																								
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Fdd2 (43) a: 18.30±1 b: 18.63±1 c: 6.60±2 Z: 8 D: 2.245 α: β: γ:																																											
ORIGIN OF SAMPLE Obtained From Eckert	REMARKS		PARTICLE SIZE	CONC. 1 mg																																								
			MAJOR ABSORPTION BANDS (cm ⁻¹)																																									
			<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3550</td> <td rowspan="3">) ms</td> </tr> <tr> <td></td> <td>A₃</td> <td>3405</td> </tr> <tr> <td></td> <td></td> <td>3290</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1685</td> <td></td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1055</td> <td rowspan="2">) sh</td> <td rowspan="2">s</td> </tr> <tr> <td></td> <td></td> <td>1000</td> </tr> <tr> <td></td> <td>D₂</td> <td>628</td> <td rowspan="3">) ms</td> </tr> <tr> <td></td> <td></td> <td>581</td> </tr> <tr> <td>D</td> <td></td> <td>425</td> </tr> <tr> <td></td> <td>D₃</td> <td>405</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>380</td> <td></td> <td>m</td> </tr> </table>		A	A ₂	3550	) ms		A ₃	3405			3290	B	B ₂	1685		mw		D ₁	1055	) sh	s			1000		D ₂	628	) ms			581	D		425		D ₃	405		ms		
A	A ₂	3550	) ms																																									
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		380		m																																								

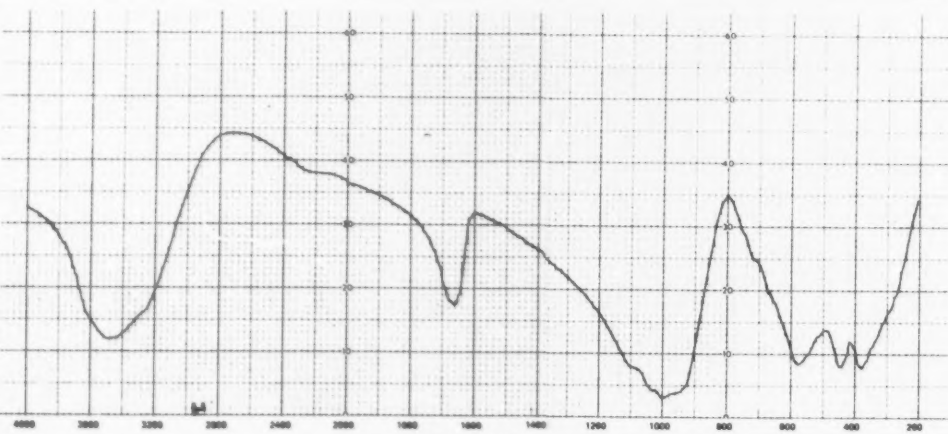
MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO																																																																													
SCOLECITE		ZEOLITE	TECTOSILICATES	A85																																																																													
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																																																																															
Ca(Al ₂ Si ₃)O ₁₀ ·3H ₂ O																																																																																	
CRYSTAL SYSTEM	SPACE GROUP	a: 18.48 α:	b: 18.95 β: 90°39'	c: 6.54 γ:	Z: 8	D: 2.262																																																																											
MONOCLINIC	Cc (9)																																																																																
ORIGIN OF SAMPLE	REMARKS			PARTICLE SIZE	CONC																																																																												
Teigarhorn, ICELAND					1 mg																																																																												
					MAJOR ABSORPTION BANDS (cm⁻¹)																																																																												
					<table><tr><td>A</td><td>A₁</td><td>3598</td><td>ms</td></tr><tr><td></td><td></td><td>3515</td><td>ms</td></tr><tr><td></td><td></td><td>3415</td><td>ms</td></tr><tr><td></td><td></td><td>3335</td><td>m</td></tr><tr><td></td><td>A₃</td><td>3235</td><td>ms</td></tr><tr><td>B</td><td>B₁</td><td>1677</td><td></td></tr><tr><td></td><td></td><td>1655</td><td>sh m</td></tr><tr><td>C</td><td></td><td>1595</td><td>w</td></tr><tr><td></td><td></td><td>1100</td><td>m</td></tr><tr><td></td><td></td><td>1065</td><td>mw</td></tr><tr><td>D₁</td><td></td><td>1020</td><td></td></tr><tr><td></td><td></td><td>990</td><td>s</td></tr><tr><td></td><td></td><td>950</td><td></td></tr><tr><td>D</td><td></td><td>930</td><td>ms</td></tr><tr><td></td><td></td><td>720</td><td>ms</td></tr><tr><td>D₂</td><td></td><td>690</td><td>m</td></tr><tr><td></td><td></td><td>625</td><td>ms</td></tr><tr><td></td><td></td><td>490</td><td>nw</td></tr><tr><td>D₃</td><td></td><td>420</td><td>ms</td></tr><tr><td></td><td></td><td>320</td><td>w</td></tr></table>		A	A ₁	3598	ms			3515	ms			3415	ms			3335	m		A ₃	3235	ms	B	B ₁	1677				1655	sh m	C		1595	w			1100	m			1065	mw	D ₁		1020				990	s			950		D		930	ms			720	ms	D ₂		690	m			625	ms			490	nw	D ₃		420
A	A ₁	3598	ms																																																																														
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		320	w																																																																														

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
HEULANDITE		ZEOLITE	TECTOSILICATES	A80		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
(Na,Ca) ₄₋₆ Al ₆ (Al,Si) ₄ Si ₂₆ O ₇₂ ·24H ₂ O						
CRYSTAL SYSTEM	SPACE GROUP	a: 15.85 α:	b: 17.80 β: 91°26'	c: 7.45 γ:	Z: 1	D: 2.157
MONOCLINIC	12/m (12)					
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC.
Paterson, NEW JERSEY, USA						1 mg
					MAJOR ABSORPTION BANDS (cm ⁻¹)	
					A A ₁ <u>3630</u>) m A ₂ <u>3480</u>) sh B B ₂ <u>1640</u>) mw D ₁ <u>1190</u>) w D ₁ <u>1040</u>) s D D ₂ <u>775</u>) w D ₂ <u>720</u>) w D ₃ <u>595</u>) m D ₃ <u>455</u>) ms	

MINERAL NAME CLINOPTILOLITE	SUB GROUP	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO 416
CHEMICAL FORMULA (IDEAL) $(\text{Na}, \text{K}, \text{Ca})_{2-3} [\text{Al}_3 (\text{Al}, \text{Si})_2 \text{Si}_{13}]_{36} \cdot 12\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP I2/m (12)	a: 7.41 α:	b: 17.89 β: 91°29'	c: 15.85 γ:
ORIGIN OF SAMPLE Hector, CALIFORNIA, USA		REMARKS		PARTICLE SIZE 1 mg
				MAJOR ABSORPTION BANDS (cm⁻¹) A $\begin{matrix} \text{A}_1 & 3620 \\ \text{A}_2 & 3490 \end{matrix} \left. \begin{matrix} \text{sh} \\ \text{ms} \end{matrix} \right\}$ B $\begin{matrix} \text{B}_2 & 1640 \\ \text{D}_1 & 1205 \\ & 1060 \end{matrix} \left. \begin{matrix} \text{ms} \\ \text{w} \\ \text{s} \end{matrix} \right\}$ D $\begin{matrix} & 795 \\ & 785 \end{matrix} \left. \begin{matrix} \text{mw} \\ \text{w} \end{matrix} \right\}$ $\begin{matrix} \text{D}_2 & 715 \\ & 665 \\ & 605 \end{matrix} \left. \begin{matrix} \text{w} \\ \text{w} \\ \text{ms} \end{matrix} \right\}$ $\begin{matrix} \text{D}_3 & 455 \end{matrix} \left. \begin{matrix} \text{s} \end{matrix} \right\}$

MINERAL NAME STILBITE	SUB GROUP	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO A81
CHEMICAL FORMULA (IDEAL) $\text{NaCa}_2 (\text{Al}_5 \text{Si}_{13})_{36} \cdot 14\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM MONOCLINIC	SPACE GROUP I2/m (12)	a: 13.681±5 α:	b: 18.182±5 β: 129°08'	c: 11.300±5 γ:
ORIGIN OF SAMPLE Kumano, Mie, JAPAN		REMARKS Also reported a=11.29, b=18.13, c=10.88 and β=104°22'		PARTICLE SIZE 1 mg
				MAJOR ABSORPTION BANDS (cm⁻¹) A $\begin{matrix} \text{A}_2 & 3600 \\ \text{A}_2 & 3450 \end{matrix} \left. \begin{matrix} \text{sh} \\ \text{m} \end{matrix} \right\}$ B $\begin{matrix} \text{B}_2 & 1650 \\ \text{D}_1 & 1140 \\ & 1025 \end{matrix} \left. \begin{matrix} \text{mw} \\ \text{w} \\ \text{s} \end{matrix} \right\}$ D $\begin{matrix} & 705 \\ \text{D}_2 & 655 \\ & 435 \end{matrix} \left. \begin{matrix} \text{w} \\ \text{m} \\ \text{ms} \end{matrix} \right\}$

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
PHILLIPSITE		ZEOLITE	TECTOSILICATES	A90		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
(K ₂ ,Na ₂ ,Ca) (Al ₂ Si ₄)O ₁₂ ·4-5H ₂ O						
CRYSTAL SYSTEM	SPACE GROUP	a: 10.02 α:	b: 14.28 β: 125°40'	c: 8.64 γ:	Z: 2	D:2.198
MONOCLINIC	P2 ₁ /m (11)					
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC
Acqua Acetosa, Rome, ITALY						1 mg
					MAJOR ABSORPTION BANDS (cm ⁻¹)	
					A A ₂ 3460) ms A ₃ 3250) sh B B ₂ 1655 mw D ₁ 1090) sh 1000) s D 580 m D ₃ 440 ms 382 m	

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO		
GISMONDINE	PHILLIPSITE	ZEOLITES	TECTOSILICATES	A297		
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)				
Ca ₄ [(AlO) ₈ (SiO ₂) ₈]·16H ₂ O						
CRYSTAL SYSTEM	SPACE GROUP	a: 10.02 α:	b: 10.62 β: 92°25'	c: 9.84 γ:	Z: 1	D: 2.224
MONOCLINIC	P2 ₁ /c (14)					
ORIGIN OF SAMPLE	REMARKS				PARTICLE SIZE	CONC
GSC 60401						2 mg
					MAJOR ABSORPTION BANDS (cm ⁻¹)	
					A A ₂ 3490) — s A ₃ 3260) sh B B ₂ 1656 ms D ₁ 1090) sh D 1000) s D ₃ 575 s 380 s	

MINERAL NAME MORDENITE	SUB GROUP	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO A92																																																		
CHEMICAL FORMULA (IDEAL) $(Ca, Na_2, K_2)(Al_2Si_{10})O_{24} \cdot 7H_2O$		CHEMICAL FORMULA (ACTUAL)																																																				
CRYSTAL SYSTEM ORTHORHOMBIC	SPACE GROUP Cmc2 () or Cmc	a: 18.13 α:	b: 20.49 β:	c: 7.52 γ:																																																		
ORIGIN OF SAMPLE Lovelock, NEVADA, USA		REMARKS	PARTICLE SIZE	CONC 1 mg																																																		
			MAJOR ABSORPTION BANDS (cm⁻¹) <table> <tr> <td>A</td> <td>A₁</td> <td>3660</td> <td>sh</td> <td>m</td> </tr> <tr> <td></td> <td>A₂</td> <td>3440</td> <td></td> <td></td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1640</td> <td></td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>1218</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>1058</td> <td></td> <td>s</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>785</td> <td></td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>720</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>575</td> <td></td> <td>m</td> </tr> <tr> <td></td> <td>D₃</td> <td>460</td> <td>sh</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>435</td> <td></td> <td></td> </tr> </table>		A	A ₁	3660	sh	m		A ₂	3440			B	B ₂	1640		mw		D ₁	1218		w			1058		s	D	D ₂	785		mw			720		w			575		m		D ₃	460	sh	ms			435		
A	A ₁	3660	sh	m																																																		
	A ₂	3440																																																				
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	D ₁	1218		w																																																		
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D	D ₂	785		mw																																																		
		720		w																																																		
		575		m																																																		
	D ₃	460	sh	ms																																																		
		435																																																				

MINERAL NAME CHABAZITE	SUB GROUP	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO 423																																																												
CHEMICAL FORMULA (IDEAL) $Ca(Al_2Si_4)O_{12} \cdot 6H_2O$		CHEMICAL FORMULA (ACTUAL)																																																														
CRYSTAL SYSTEM TRIGONAL	SPACE GROUP R$\bar{3}$m (166)	a: 13.78 α:	b: β:	c: 15.01 γ:																																																												
ORIGIN OF SAMPLE (Bowie) Christmas, ARIZONA, USA		REMARKS RHOMBOHEDRAL a_{rh} = 9.40, x = 94°18' z = 2	PARTICLE SIZE	CONC 1 mg																																																												
			MAJOR ABSORPTION BANDS (cm⁻¹) <table> <tr> <td>A</td> <td>A₂</td> <td>3570</td> <td>sh</td> <td></td> </tr> <tr> <td></td> <td></td> <td>3440</td> <td></td> <td>s</td> </tr> <tr> <td></td> <td>A₃</td> <td>3250</td> <td>sh</td> <td></td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1650</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>1150</td> <td>sh</td> <td>s</td> </tr> <tr> <td></td> <td></td> <td>1030</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>760</td> <td></td> <td>w</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>720</td> <td></td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>632</td> <td></td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>515</td> <td></td> <td></td> </tr> <tr> <td></td> <td>D₃</td> <td>460</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>415</td> <td></td> <td>ms</td> </tr> </table>		A	A ₂	3570	sh				3440		s		A ₃	3250	sh		B	B ₂	1650		ms		D ₁	1150	sh	s			1030					760		w	D	D ₂	720		w			632		ms			515				D ₃	460					415		ms
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	D ₃	460																																																														
		415		ms																																																												

MINERAL NAME ERIONITE	SUB GROUP	GROUP ZEOLITE	CLASS TECTOSILICATES	SPECTRA NO 414																																																				
CHEMICAL FORMULA (IDEAL) $(\text{Ca}, \text{Na}_2, \text{K}_2)_4 (\text{Al}_8 \text{Si}_{28}) \text{O}_{72} \cdot 27\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL)																																																						
CRYSTAL SYSTEM HEXAGONAL	SPACE GROUP $P6_3/mmc (194)$	$a: 13.20$ $\alpha:$	$b:$ $\beta:$	$c: 15.07$ $\gamma:$ Z: 1 D: 2.07																																																				
ORIGIN OF SAMPLE Needle Peak, NEVADA, USA	REMARKS		PARTICLE SIZE	CONC 1 mg																																																				
			MAJOR ABSORPTION BANDS (cm^{-1})																																																					
			<table> <tr><td>A</td><td>A₂</td><td>3520</td><td>br</td><td>m</td></tr> <tr><td>B</td><td>B₂</td><td>1645</td><td></td><td>m</td></tr> <tr><td></td><td></td><td>1140</td><td>sh</td><td></td></tr> <tr><td>D₁</td><td></td><td>1040</td><td></td><td>s</td></tr> <tr><td></td><td></td><td>775</td><td></td><td>m</td></tr> <tr><td>D₂</td><td></td><td>720</td><td></td><td>w</td></tr> <tr><td>D</td><td></td><td>630</td><td></td><td>mw</td></tr> <tr><td></td><td></td><td>575</td><td></td><td>w</td></tr> <tr><td>D₃</td><td></td><td>465</td><td></td><td>ms</td></tr> <tr><td></td><td></td><td>435</td><td></td><td></td></tr> <tr><td></td><td></td><td>405</td><td></td><td></td></tr> </table>		A	A ₂	3520	br	m	B	B ₂	1645		m			1140	sh		D ₁		1040		s			775		m	D ₂		720		w	D		630		mw			575		w	D ₃		465		ms			435				
A	A ₂	3520	br	m																																																				
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MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	$a:$ $\alpha:$	$b:$ $\beta:$	$c:$ $\gamma:$ Z: D:
ORIGIN OF SAMPLE	REMARKS		PARTICLE SIZE	CONC mg
			MAJOR ABSORPTION BANDS (cm^{-1})	

MINERAL NAME INDIANITE	SUB GROUP	GROUP	CLASS	SPECTRA NO. A173																								
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																										
CRYSTAL SYSTEM NON-CRYSTALLINE ~POORLY CRYSTALLINE	SPACE GROUP ()	a: α:	b: β:	c: γ:																								
ORIGIN OF SAMPLE INDIANA, USA		REMARKS		PARTICLE SIZE CONC. 1 mg																								
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3500</td> <td>ms</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1645</td> <td>mw</td> </tr> <tr> <td></td> <td>D₁</td> <td>970</td> <td>ms</td> </tr> <tr> <td></td> <td></td> <td>570</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₃</td> <td>420</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>335</td> <td>w</td> </tr> </table>	A	A₂	3500	ms	B	B₂	1645	mw		D₁	970	ms			570	ms	D	D₃	420	w			335	w
A	A₂	3500	ms																									
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	D₁	970	ms																									
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D	D₃	420	w																									
		335	w																									

MINERAL NAME ALLOPHANE	SUB GROUP	GROUP	CLASS	SPECTRA NO. 417																												
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL) $\text{Al}_2\text{O}_3 / (\text{Al}_2\text{O}_3 + \text{SiO}_2) = 0.4$																														
CRYSTAL SYSTEM NON-CRYSTALLINE	SPACE GROUP ()	a: α:	b: β:	c: γ:																												
ORIGIN OF SAMPLE Synthetic		REMARKS		PARTICLE SIZE CONC. 1 mg																												
				MAJOR ABSORPTION BANDS (cm⁻¹) <table border="1"> <tr> <td>A</td> <td>A₂</td> <td>3500</td> <td>ms</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1650</td> <td>mw</td> </tr> <tr> <td></td> <td></td> <td>1140</td> <td>sh</td> </tr> <tr> <td></td> <td>D₁</td> <td>1040</td> <td>ms</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>890</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>575</td> <td>w</td> </tr> <tr> <td></td> <td>D₃</td> <td>440</td> <td>mw</td> </tr> </table>	A	A₂	3500	ms	B	B₂	1650	mw			1140	sh		D₁	1040	ms	D	D₂	890	w			575	w		D₃	440	mw
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		1140	sh																													
	D₁	1040	ms																													
D	D₂	890	w																													
		575	w																													
	D₃	440	mw																													

MINERAL NAME ALLOPHANE	SUB GROUP	GROUP	CLASS HYDROUS ALUMINO-SILICATES	SPECTRA NO. A608																		
CHEMICAL FORMULA (IDEAL): $\chi\text{Al}_2\text{O}_3 \cdot \text{Y}\text{SiO}_2 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL): $\text{Y} > \text{X}$ $\text{Y} = 2$ $\text{X} = 1$																				
CRYSTAL SYSTEM NON-CRYSTALLINE	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:																		
ORIGIN OF SAMPLE Shichihonzakura, JAPAN	REMARKS		PARTICLE SIZE 2 μm	CONC. 1 mg																		
			MAJOR ABSORPTION BANDS (cm^{-1})																			
			<table> <tr><td>A</td><td>3475</td><td>vs</td></tr> <tr><td>B</td><td>1630</td><td>ms</td></tr> <tr><td>C</td><td>1400*</td><td>m</td></tr> <tr><td>D₁</td><td>970</td><td>vs</td></tr> <tr><td>D</td><td>575</td><td>s</td></tr> <tr><td>D₃</td><td>425</td><td>sh w</td></tr> <tr><td></td><td>340</td><td>mw</td></tr> </table>		A	3475	vs	B	1630	ms	C	1400*	m	D ₁	970	vs	D	575	s	D ₃	425	sh w
A	3475	vs																				
B	1630	ms																				
C	1400*	m																				
D ₁	970	vs																				
D	575	s																				
D ₃	425	sh w																				
	340	mw																				

MINERAL NAME IMOGOLITE	SUB GROUP	GROUP	CLASS HYDROUS ALUMINUM-SILICATES	SPECTRA NO. A153																					
CHEMICAL FORMULA (IDEAL): $\chi\text{Al}_2\text{O}_3 \cdot \text{Y}\text{SiO}_2 \cdot n\text{H}_2\text{O}$		CHEMICAL FORMULA (ACTUAL): $\text{X} = \text{Y}$																							
CRYSTAL SYSTEM	SPACE GROUP ()	a: α :	b: β :	c: γ : Z: D:																					
ORIGIN OF SAMPLE Kurayoshi, Tottori, JAPAN	REMARKS		PARTICLE SIZE	CONC. 2 mg																					
			MAJOR ABSORPTION BANDS (cm^{-1})																						
			<table> <tr><td>A</td><td>A₂</td><td>3500</td><td>s</td></tr> <tr><td>B</td><td>B₂</td><td>1640</td><td>m</td></tr> <tr><td></td><td>D₁</td><td>970</td><td>s</td></tr> <tr><td></td><td></td><td>580</td><td></td></tr> <tr><td>D</td><td>D₂</td><td>425</td><td>w</td></tr> <tr><td></td><td></td><td>340</td><td>w</td></tr> </table>		A	A ₂	3500	s	B	B ₂	1640	m		D ₁	970	s			580		D	D ₂	425	w	
A	A ₂	3500	s																						
B	B ₂	1640	m																						
	D ₁	970	s																						
		580																							
D	D ₂	425	w																						
		340	w																						

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.																												
PENWITHITE				A180																												
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)																														
$\text{MnSiO}_3 \cdot n\text{H}_2\text{O}$																																
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:																												
NON-CRYSTALLINE	()	α :	β :	γ :																												
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE		CONC.																												
Taguchi Mine, Aichi, JAPAN				4 mg																												
				MAJOR ABSORPTION BANDS (cm⁻¹)																												
				<table border="0"> <tr> <td>A</td> <td>A₂</td> <td>3440</td> <td>mw</td> </tr> <tr> <td>B</td> <td>B₂</td> <td>1630</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>1013</td> <td>ms</td> </tr> <tr> <td></td> <td>D₁</td> <td>945</td> <td>sh</td> </tr> <tr> <td></td> <td></td> <td>865</td> <td>sh</td> </tr> <tr> <td>D</td> <td>D₂</td> <td>713</td> <td>w</td> </tr> <tr> <td></td> <td></td> <td>575</td> <td>w</td> </tr> <tr> <td></td> <td>D₃</td> <td>450</td> <td>ms</td> </tr> </table>	A	A ₂	3440	mw	B	B ₂	1630	w			1013	ms		D ₁	945	sh			865	sh	D	D ₂	713	w			575	w
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D	D ₂	713	w																													
		575	w																													
	D ₃	450	ms																													

MINERAL NAME	SUB GROUP	GROUP	CLASS	SPECTRA NO.
CHEMICAL FORMULA (IDEAL)		CHEMICAL FORMULA (ACTUAL)		
CRYSTAL SYSTEM	SPACE GROUP	a:	b:	c:
	()	α :	β :	γ :
ORIGIN OF SAMPLE	REMARKS	PARTICLE SIZE		CONC.
				mg
				MAJOR ABSORPTION BANDS (cm⁻¹)

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or = CORONADITE	
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CHINA CLAY	= mainly well-cryst. KAOLINITE
CHLORAPATITE	69
CHLORITE-MICA	
CHLORITE-SMECTITE	154
CHLORITE-SMECTITE, dioctahedral 1:1 regular	
_____ = TOSUDITE	
CHLORITE-SMECTITE, trioctahedral 1:1 regular	
_____ = CORRESITE (low charge)	155
CHLORITE-TALC	
CHLORITE-VERMICULITE, trioctahedral 1:1 regular	
_____ = CORRENSITE (High charge)	153
CHLORITES	a mineral group
_____ 1a	= rare polytype
_____ 1b	= less common polytype
_____ 11b	= the most common polytype
_____ dioctahedral ..	see DONBASSITE, SUDOITE, COOKEITE
_____ trioctahedral ..	see CLINOCHLORE, CHAMOSITE, PENNATITE, NIMITE
CHLORITOID	117
CHLOROPAL	= NONTRONITE
CHRYSOCOLLA	158
CHRYSOPRASE	var. QUARTZ
CHRYSOTILE	113, 114, 115
_____ 1M	
_____ 2Mc (fibres elongated along a)	
_____ 2Mp (fibres elongated along b)	
_____ 20r	
CITRINE	var. QUARTZ
CLEAVELANDITE	var. ALBITE
CLINOCHLORE	132
_____ (Cr-)	134
_____ (Fe-)	133

CLINOCHLORE (Mn-)	135
CLINOCHRYSTILE	= CHRYSOTILE 2Mc
CLINOENSTATITE	
CLINOFERROSILITE	
CLINOHYPERSTHENE	
CLINOPTILOLITE	177
CLINOZOISITE	
CLINTONITE	129
COLLOPHANE	
COOKEITE	131
COPIAPITE	57
COQUIMBITE	50
CORDIERITE	91
CORONADITE	
CORRENSITE	153, 155
CORUNDOPHILITE	
CORUNDUM	9
CRANDALLITE	
CRISTOBALITE	
CROCIDOLITE	var. RIEBECKITE
CROCOITE	
CRONSTEDTITE	116
CRYOPTOMELANE	
CUMMINGTONITE	99
CYANITE	= KYANITE
CYCLOSILICATES	a mineral family
CYRTOLITE	var. ZIRCON

- D -

DAPHNITE	= CHAMOSITE
DATOLITE	
DELLESITE	= CLINOCHLORE, ferroan
δ -MnO ₂	133
DESMINE	= STILBITE
DEWEYLITE	
DIABANTITE	= CLINOCHLORE, ferroan
DIAMOND	133
DIASPORE	
DICKITE	18
DIOPSIDE	107
DIOPTASE	94
DOLOMITE	91
DONBASSITE	37
DRAVITE	
DUFRENITE	92
	68

- E -

EARDLEYITE	
ECKERMANITE	
EDENITE	
EDINTONITE	101
ELBAITE	
EMERALD	var. BERYL
ENDELLITE	92
ENSTATITE	= HALLOYSITE-10A
	90

EPHESITE	130
EPIDESMINE	= STILBITE
EPIDOTE	88
EPISTILBITE	
EPSOMITE	49
ERIONITE	180
ERYTHRITE	
ETTRINGITE	
EUDIALYTE	89

- F -

FASSAITE	
FUJASITE	
FAYALITE	78
FELDSPAR	a mineral group
FELDSPATH	= FELDSPAR
FELDSPAR	= FELDSPAR
FERRIHYDRITE	20
FERRIPHLOGOPITE	
FERROSILITE	
FIRE CLAY	= Mainly KAOLINITE but sometime containing DICKITE, NACRITE, DIASPORE, BOEHMITE etc.
FLINT CLAY	= Mainly KAOLINITE or HALLOYSITE
FLORENCITE	
FLUORAPATITE	67,68
FLUORITE	
FLUORPHLOGOPITE	
FORSTERITE	78
FRANKLINITE	14
FUCHSITE	var. MUSCOVITE, chromian.....124
FULLER'S EARTH	MONTMORILLONITE or PALLYGORSKITE having strong active surfaces.

- G -

GAHNITE	13
γ -Al(OH) ₃	= NORDSTRANDITE
γ -Fe ₂ O ₃	= MAGHEMITE
γ -FeO(OH)	= LEPIDOCROCITE
γ -MnO(OH)	= MANGANITE
GARNET	a mineral group
GARNIERITES	a general term for hydrous nickel silicates
GASPEITE	30
GAYLUSSITE	
GEDERITE	
GEHLENITE	
GIBBSITE	21
GISMONDINE	178
GLAUCONITE	123
GLAUCONITE-SMECTITE	
GLAUCOPHANE	
GMELINITE	
GOETHITE	16
GORCEIXITE	
GOYAZITE	64

GRANDITE	= GARNET SUB- GROUP	
GRAPHITE		
GREENALITE		116
GRIFFITHITE	= SAPONITE, ferroan	
GROSSULAR	(GROSSULARITE)	80
GROUTITE		
GROVESITE	= Mg-PENNANTITE	
GRUNERITE		
GYPSUM		48

- H -

HACKMANITE	var. of SODALITE	
HALLOYSITE-7A		109, 110
HALLOYSITE-10A		111, 112
HALLOYSITES	a mineral group	
HALOTRICHITE		49
HANKSITE		
HARMOTOME		
HASTINGSITE		
HAUSMANNITE		14
HECTORITE		147
HEDENBERGITE		
HELVITE		82
HEMATITE		9
HEMIMORPHITE		87
HENDRICKSITE		
HERCYNITE		
HETEROGENITE		
HETEROSITE		
HEULANDITE		176
HEXAHYDRITE		
HIDDENITE	var. of SPODUMENE	
HISINGERITE		
HOLLANDITE		
HOLMQUISTITE		
HOPEITE		
HORNBLende		100
HORTONOLITE	= FAYALITE, magnesian	
HUMITE		
HUNTITE		
HYALITE		
HYALOPHANE		
HYDRARGILLITE	= GIBBSITE	
HYDRATED HALLOYSITE	= HALLOYSITE-10A	
HYDROHEMATITE		
HYDROMAGNESITE		
HYDROMICAS	a general term	
HYDROMUSCOVITE	var. of MUSCOVITE	
HYDRONIUM JAROSITE		56
HYDROXY-APATITE		69
HYPERSTHENE		93

- I -

IDOCRASE	= VESUVIANITE	
ILLITE	a general term	
ILLITE-CHLORITE	see MICA-CHLORITE	
ILLITE-SMECTITE	see MICA-SMECTITE	
ILLITE-VERNUCYKUTE	see MICA-VERMICULITE	
ILMENITE		10
IMOGOLITE		182
INDIANITE		181
INOSILICATES	a mineral family	

- J -

JADEITE		95
JAROSITE		54
JASPER	= mix QUARTZ + IRON OXIDES	
JEFFERSONITE		
JENKINSITE	= ANTIGORITE, ferroan	
JOHANNSENITE		

- K -

KAMMERERITE	= CLINOCHLORE, chromian	
KAOLIN	Kaolinitic rock or powder	
KAOLINITE		104
_____ - ITC		105, 113
_____ - (DISORDERED)		106
KAOLINITE-SERPENTINE	a mineral group	
KAOLINITE-SMECTITE		149
KAOLINITES	Kaolinite-Serpentine Sub-Group, dioctahedral see also DICKITE, HALLOYSITE, KAOLINITE, NACRITE, etc.	
KANDITE	= KAOLINITE-SERPENTINE	
KELLYITE		
KENYAITE		
KEROLITE		
K-FELDSPAR	= MICROCLINE or ORTHOCLASE	
KIESERITE		
KINGITE		
KINOSHITALITE		
KMAITE	= CELADONITE	
KNEBELITE	= FAYALITE, manganoan	
KOZULITE		
KRÖHNKITE		46
KULKEITE	= CHLORITE-TALC	
KUNZITE	var. SPODUMENE	
KYANITE		85

- L -

LABRADORITE		166
LAPIS-LAZULI	var. LAZURITE	
LAUMONTITE		

- 191 -

- L -

LAWSONITE	
LAZULITE	
LAZURITE	
LEADHILLITE	
LEMBERGITE	
LEPIDOCROCITE	17
LEPIDOLITE	128
LEPIDOMELAIN	= BIOTITE, ferrian
LEPTOCHLORITE	= OXIDIZED CHLORITE
LEUCHTENBERGITE	= CLINOCHLORE
LEUCITE	171
LEUCOXENE	a general term for alteration products of ILMENITE
LEVYNE, LEVYNITE	
LIMONITE	a general term for hydrous iron oxides, mostly GOETHITE
LINARITE	52
LIZARDITE	

- M -

MACKINAWITE	
MAGADIITE	158
MAGHEMITE	10
MAGNESIOFERRITE	
MAGNESITE	30
MAGNETITE	13
MAKATITE	
MALACHITE	
MANASSEITE	26
MANGANITE	18
MANGANOPHYLLITE	= BIOTITE, manganoan
MANGANOSITE	
MARGASITE	
MARGARITE	129
MARIALITE	
MARIPOSITE	= PHENGITE, chromian
MASCAGNITE	
MEDMONTITE	mix. CRYSOCOLLA + MICA
MEERSCHAUM	= SEPIOLITE
MEIONITE	
MELANTERITE	
METAHALLOYSITE	= HALLOYSITE - 7A
METAVARISCITE	62
MICA-CHLORITE	
MICA-SMECTITE	149, 151, 152, 153
MICA-SMECTITE, dioctahedral 1:1 regular	= RECTORITE
MICA (Ca-)SMECTITE, dioct. 1:1 regular	= Ca-RECTORITE

MICA (K-)-SMECTITE, dioct. 1:1 regular = K-RECTORITE	
MICA (Na-)-SMECTITE, dioct. 1:1 regular = Na-RECTORITE	
MICA-SMECTITE, dioctahedral 3:1 regular = TARASOVITE	
MICA-VERMICULITE	
MICA-VERMICULITE, trioctahedral 1:1 regular = HYDROBIOTITE	
MICAS, dioctahedral See MUSCOVITE, CELADONITE, GLAUCONITE etc	
MICAS, trioctahedral..... See PHLOGOPITE, BIOTITE, LEPIDOLITE etc	
MICROCLINE, maximum	159
MICROCLINE, low	
MIMETITE	73
MINNESOTAITE	119
MIRABILITE	45
MIZZONITE	
MONAZAITE	60
MONTMORILLONITE	140-143
_____ (Ca ²⁺ -)	140
_____ (CHETO TYPE)	142, 143
_____ (K ⁺ -)	141
_____ (Mg ²⁺ -)	140
_____ (Na ⁺ -)	141
_____ (NH ₄ ⁺ -)	142
_____ (WYOMING TYPE)	140, 141, 142
MORDENITE	179
MORGANITE var. BERYL	
MORION = SMOKY QUARTZ	
MULLITE	
MUSCOVITE-1M	121
_____ (1M+2M ₁)	121
_____ 2M ₁	120
_____ 2M ₂	122
_____ 3T	122

- N -

NACRITE	108
NAHCOLITE	
NATROALUNITE	54
NATROJAROSITE	55
NATROLITE	175
NATRON	
NEMALITE = BRUCITE, ferroan	
NEPHELINE	171
NEPHRITE var. ACTINOLITE	102
NEPOUITE	
NESOSILICATES a mineral family	
NESQUEHONITE	
NIMESITE	
NIMITE	
NONTRONITE	144
NORDSTRANDITE	23

OBSIDIAN	170
OCTAHEDRITE	= ANATASE
OELLACHERITE	= MUSCOVITE, barium-bearing
OLIGOCLASE	164
OLIVENITE	74
OLIVINES	a mineral group
OMPHACITE	79
OPAL	170
ORTHOCHLORITE	= a majority of chlorites containing no Fe ³⁺
ORTHOCHRYSTILE	= CHRYSOTILE having an orthorhombic structure 20 _r
ORTHOCLASE	160
ORTHOERROSILITE	
ORTHOSILICATES	= NESOSILICATES + SOROSILICATES + CYCLOSILICATES
OTAVITE	
OTTRELITE	= CHLORITOID, manganian

PALYGORSKITE	155
PARACHRYSTILE	= CHRYSOTILE-2Mp
PARAGONITE	125
PARGASITE	
PAULINGITE	
PECORAITE	115
PENNANTITE	
PENNINE, PENNINITE	= CLINOCHLORE
PENWITHITE	183
PERIDOT	var. FORSTERITE
PHENGITE-1M	123
PHENGITE, chromian	124
PHILLIPSITE	178
PHLOGOPITE-1M	125
-----2M ₁	
-----3T	
PHYLOSILICATES	a mineral family
PIGEONITE	93
PIMELITE	
PLAGIOCLASE	
PLUMBOGUMMITE	64
PLUMBOJAROSITE	
POLLUCITE	172
POLYHALLITE	47
POLYLITHIONITE	
PORTLANDITE	20
POTASH FELDSPAR	= POTASSIUM FELDSPAR
POTASSIUM FELDSPAR	= MICROCLINE OR ORTHOCLASE
PREHNITE	157
PROCHLORITE	
PROTOFERRIHYDRITE	
PROTOLITHIONITE	
PSEUDOBOEHMITE	
PSEUDORUTILE	
PSEUDOTHURINGITE	
PSILOMELANE	15

- P -

PTILOLITE	= MORDENITE	
PURPRITE		59
PYRITE		
PYROAURITE		25
PYROCHROITE		19
PYROMORPHITE		70
PYROPE		81
PYROPHYLLITE-1Tc		118
----- -2M		118
PYROXENES	a mineral group	
PYROXMANGITE		98
PYRRHOTITE		

- Q -

QUARTZ		169
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- R -

RANCIEITE		
RECTORITE (unspecified)		151
----- (Ca-)		
----- (K-)		152
----- (Na-)		150
----- (Na+K)		151
RHODOCHROSITE		31
RHODONITE		97
RICHTERITE		
RIEBECKITE		101
RIPIDOLITE	= ferroan var. CLINOCHLORE	
ROSCOELITE	= MUSCOVITE, vanadous	
ROZENITE		
RUBELLITE	var. ELBAITE	
RUBY	var. CORUNDUM	
RUTILE		11

- S -

SANIDINE		
SAPONITE		145
----- (Ca ²⁺ -)		146
----- (Na ⁺ -)		146
SAPPHIRE	var. CORUNDUM	
SASSOLITE		24
SAUCONITE		148
SCAPOLITE		173
SCARBROITE		
SCHORL		
SCOLECITE		176
SEPIOLITE		156
SEPTTECHLORITE	= SERPENTINE MINERAL	
SERANDITE		88

SERICITE	a general term	
SERPENTINE, KAOLITE-SERPENTINE	Sub Group, trioctahedral; see also AMESITE, ANTIGORITE, BERTHIERINE, BRINDLEYITE, CRONSTEDTITE, GREENALITE, LIZARDITE, NEPOUITE	
SEYBERTITE	= CLINTONITE	
SHERIDANITE	= CLINOCHLORE, ferroan	
SHORTITE		29
SIDERITE		
SIDEROPHYLLITE		
SIDEROTIL		
SILHYDRITE		84
SILLIMANITE		
SISMONDINE	= CHLORITOID, magnesian	
SJÖGRENITE		
SKOLITE	= 3:1 regular MICA-SMECTITE	154
SMECTITE-CHLORITE		149, 151, 152,
SMECTITE-MICA		153
SMECTITE-VERMICULITE		
SMECTITES	a mineral group	
SMECTITES, dioctahed.	see also BEIDELLITE, MONTMORILLONITE, NONTRONITE, etc.	
SMECTITES, trioctahedral,	see also HECTORITE, SAPONITE, STEVENSITE, etc.	
SMITHSONITE		32
SODA FELDSPAR	= SODIUM FELDSPAR	
SODALITE		174
SODIUM FELDSPAR	= ALBITE, PLAGIOCLASE	
SOROSILICATES	a mineral family	
SPESSARTINE		
SPHENE	= TITANITE	12
SPINEL		96
SPODUMENE		86
STAUROLITE		147
STEVENSITE		25
STICHTITE		177
STILBITE		
STILPNOMELANE		62
STRENGITE		35
STRONTIANITE		131
SUDOITE		
SULFATES ..(SULPHATES) ...	a mineral family	
SUSSEXITE		76
SVANBERGITE		
SYLVITE		
SZOMOLNOKITE		

TAENIOLITE		
TAKOVITE		
TALC		119
TALC-SMECTIRE (trioct.)	1:1 regular = ALIETTITE	
TANZANITE	var. ZOISITE	

- T -

TARANAKITE	
TARASOVITE	
TECTOSILICATES	a mineral family
THENARDITE	
THOMSONITE	
THULITE	var. ZOISITE
THURINGITE	= CHAMOSITE, ferrian
TINTICITE	72
TIRODITE	102
TITANITE	82
TOPAZ	85
TOSUDITE	154
TOURMALINE	= a mineral group
TREMOLITE	99
TRIDYMIT	169
TRIPHYLITE	58
TRIPLITE	65
TURQUOISE	71

- U -

URALITE	
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- V -

VANADINITE	73
VARISCITE	61
VATERITE	
VERMICULITE	136, 137
_____ (K ⁺ -)	138
_____ (Mg ²⁺ -)	137
VESUVIANITE	89
VOLKHONSKOITE	

- W -

WAVELLITE	70
WHITLOCKITE	59
WILLENSEITE	
WITHERITE	34
WOLLASTONITE	96
WULFENITE	75
WÜSTITE	

- X -

XANTHOPHYLLITE	= CLINTONITE
XYLOTILE	

- Y -

YOFORTIERITE	
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- Z -

ZEOLITES	a mineral group	
ZINCITE		12
ZINNWALDITE		
ZIRCON		81
ZOISITE		87
ZUNYITE		

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	× 0.04	inch
centimetre (cm)	× 0.39	inch
metre (m)	× 3.28	feet
kilometre (km)	× 0.62	mile
AREA		
square centimetre (cm ²)	× 0.15	square inch
square metre (m ²)	× 1.2	square yards
square kilometre (km ²)	× 0.39	square mile
hectare (ha)	× 2.5	acres
VOLUME		
cubic centimetre (cm ³)	× 0.06	cubic inch
cubic metre (m ³)	× 35.31	cubic feet
cubic metre (m ³)	× 1.31	cubic yards
CAPACITY		
litre (L)	× 0.035	cubic foot
hectolitre (hL)	× 22	gallons
hectolitre (hL)	× 2.5	bushels
WEIGHT		
gram (g)	× 0.04	oz avdp
kilogram (kg)	× 2.2	lb avdp
tonne (t)	× 1.1	short tons
AGRICULTURAL		
litres per hectare (L/ha)	× 0.069	gallons per acre
litres per hectare (L/ha)	× 0.357	quarts per acre
litres per hectare (L/ha)	× 0.71	pints per acre
millilitres per hectare (mL/ha)	× 0.014	fl. oz per acre
tonnes per hectare (t/ha)	× 0.45	tons per acre
kilograms per hectare (kg/ha)	× 0.89	lb per acre
grams per hectare (g/ha)	× 0.014	oz avdp per acre
plants per hectare (plants/ha)	× 0.405	plants per acre

